VOL. XXIV. Nº 1. JANUARY 1939

MECCANO MAGAZINE

THE DOUGLAS DC-4 BEFORE A TEST FLIGHT

6D.

THE 1938-9 HORNBY BOOK of TRAINS

The 1938-9 issue of the "Hornby Book of Trains" should be in the hands of every railway enthusiast.

The beautiful coloured cover shows a striking picture of the famous "*Cornish Riviera Limited*," specially painted by the well-known artist Bryan de Grineau. The contents of the Book are more varied than ever. They include articles, fully illustrated by splendid photographs, dealing with little-known features of railway goods traffic, automatic train control on the G.W.R., the famous L.N.E.R. and L.M.S. expresses on the London-Scotland routes, the mysteries of the Travelling Post Office, and the Continental Boat Trains of the Southern Railway.

In addition the Book forms a complete catalogue of Hornby Trains for electric and clockwork railways. All the Hornby Locomotives, Rolling Stock and Accessories are beautifully illustrated in full colour.

How to obtain the Book

The Hornby Book of Trains may be obtained from any Meccano dealer, price 3d., or direct from Meccano Ltd. (Dept. A.M.), Binns Road, Liverpool 13, price 4½d. post free. In the latter case a remittance in stamps should be sent and the name and address of the sender should be clearly written.

Readers living in Australia, New Zealand or South Africa who require copies should send their postal orders for 8d. (which includes postage) to the addresses given below. The Meccano Branch at Toronto will deal with Canadian orders and the price is 15 cents postpaid.

Readers living in countries other than those mentioned should order from Meccano Ltd., Binns Road, Liverpool 13, sending 6d. in stamps with their order.

AUSTRALIAN AGENTS: E. G. Page & Co., 52, Clarence St., Sydney (P.O. Box 1832k).

NEW ZEALAND AGENTS: Models Limited, Paykel's Buildings, Anzac Avenue, Auckland C.1 (P.O. Box 129).

SOUTH AFRICAN AGENT: Arthur E. Harris, 142, Market Street, Johannesburg (P.O. Box 1199).

CANADIAN BRANCH: Meccano Ltd., 187-189, Church Street, Toronto.

Published by MECCANO LTD. (Dept. A.M.), BINNS ROAD, LIVERPOOL 13

EXTRA SPECIAL EDITION

SAFETY FIRST WEEK

Hamley's News

·HAMLEY·BROTHERS·LTD·ESTABLISHED·1760·

200-202, REGENT STREET, LONDON W.1. OUR ONLY ADDRESS

Telephone: REGENT 3161

No. 34 *January, 1939*

Write for our new Catalogue of Toys. Contains 72 beautifully illustrated pages

A GRAND PASTIME FOR WINTER EVENINGS

HOW FAST?

Your speed will always be easily visible with this grand speedometer. At the same time, too, you can see just how far each trip has been by a glance at the Cyclometer which is incorporated. Wheel size 26 in., 28in.

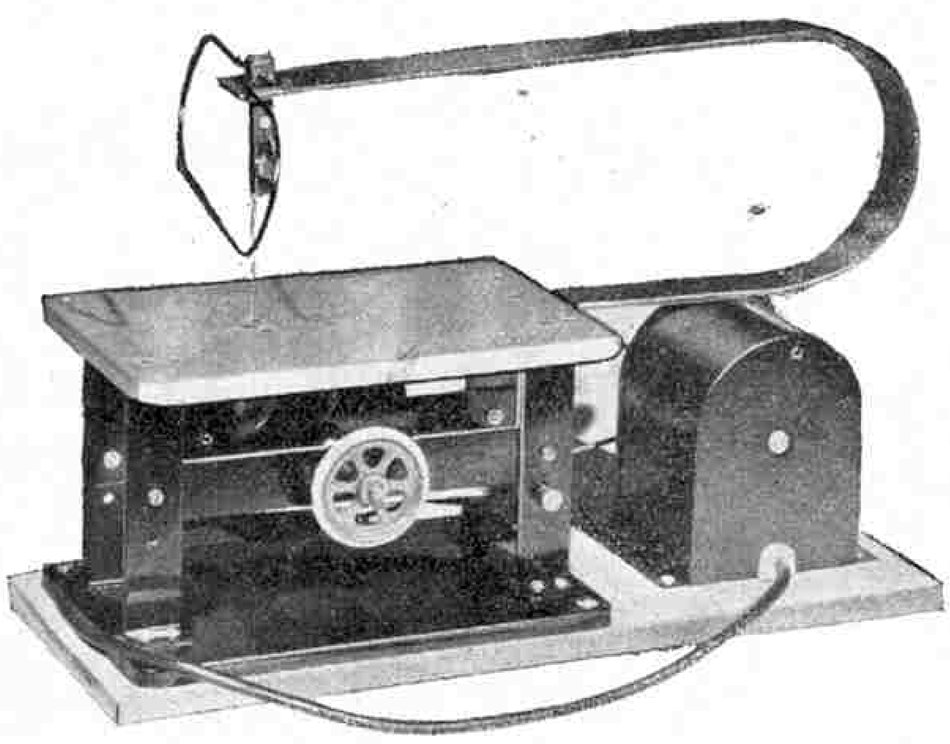
Price **19/6**

POST 6d.

Speedometer only **12/6**

Here's a hobby which will fill in those long dark evenings, and will enable you to produce useful gifts for your family—Pipe Racks—Hat Racks—Picture Frames—etc.—can all be made with this fine electrical fret machine. Suitable for A.C. mains 200 to 250 volts. Clean cutting, table size 5½" x 8¾". Very powerful machine. Cheapest electric type obtainable. *(Foreign)*

Price **37/6**



HOW FAR?

It's always much more fun to know how far you went on that long bike ride. Here's a grand handy cyclometer which is easy to fit and which every cyclist should have. Obtainable in 26 in. or 28 in. wheel.

Price **2/6**

POST 2d.

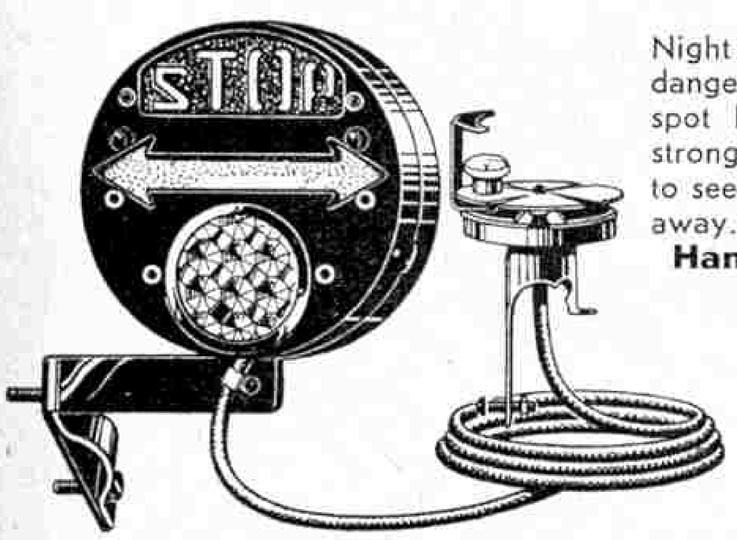
HOW STEEP?

This is a gadget which will appeal to every boy who owns a bicycle. Attached to the handle-bars it works like a spirit level, showing you what gradient the hill is that you are climbing.

Price **3/6**

POST 3d.

ROAD SAFETY SECTION



Night riding can often be dangerous so here's a special spot lamp which throws a strong beam and enables you to see objects some distance away. Operated from dynamo.

Handlebar Spot Lamp

Price

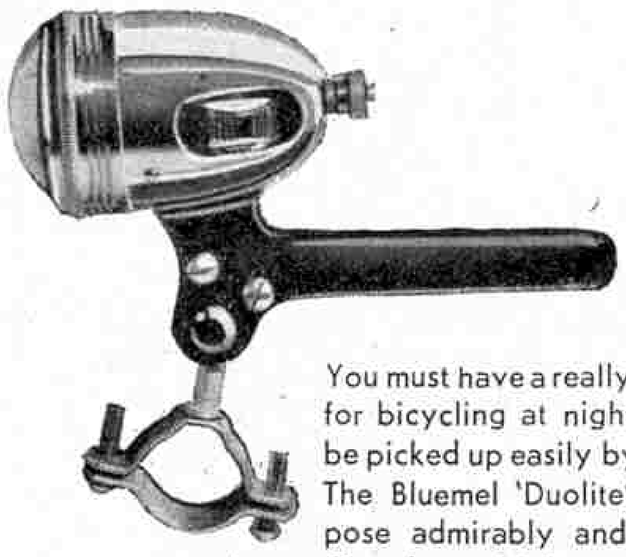
3/6

POST 3d.

(Foreign)

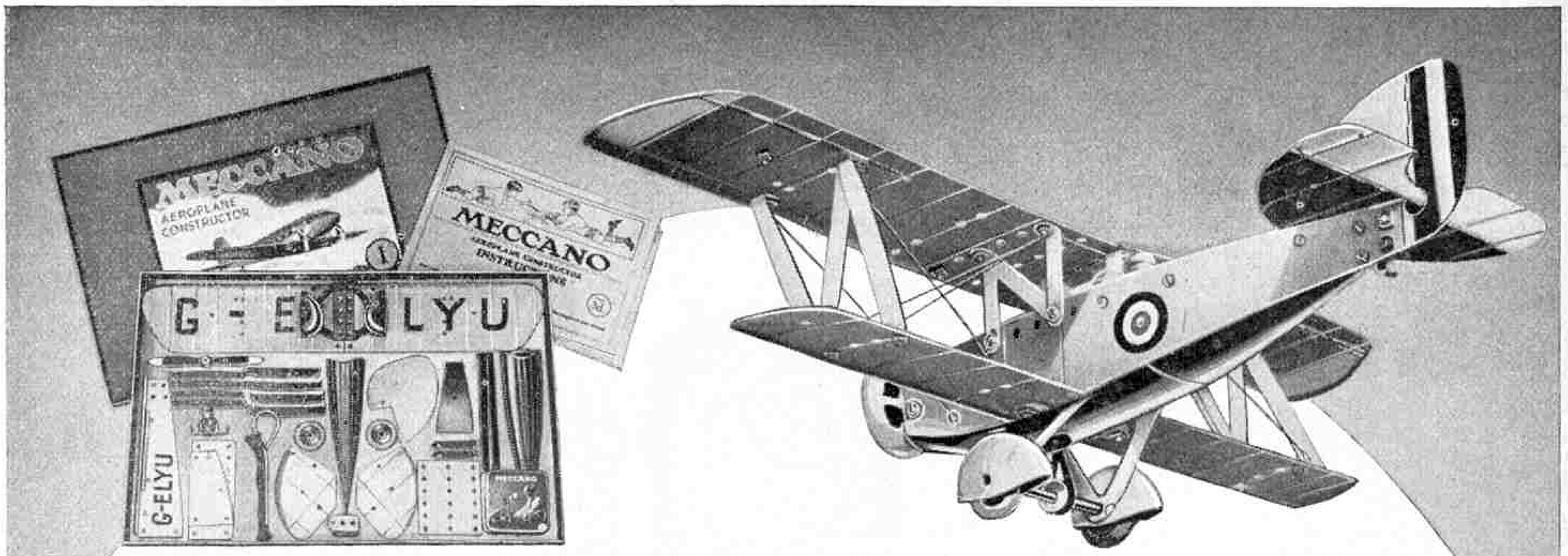
It is much better to keep your hands on the handlebars and let the Pifco Signal show whether you are turning right, left or stopping. Complete set with wiring, battery, etc.

PIFCO SIGNAL *Price* **6/6** **POST 6d.**



You must have a really *good* rear lamp for bicycling at night. One that can be picked up easily by car headlights. The Bluemel 'Duolite' suits this purpose admirably and is cheap too! Complete with battery.

Bluemel 'Duolite' *Price* **3/3** **POST 3d.**



MECCANO AEROPLANE CONSTRUCTOR OUTFITS

Every boy should know how aeroplanes are designed and constructed and should be able to recognise the different types of machines at a glance. These fine Constructor Outfits contain a range of aeroplane parts by means of which boys are able to design and build their own Aeroplanes quite easily.

Price List of Aeroplane Outfits

	Standard Series				
No. OO Outfit	3/3		No. 1 Outfit		7/11
No. O Outfit	4/6		No. 2 Outfit		13/6
	Special Series				
No. 1 Special Outfit	13/6		No. 2 Special Outfit		22/6

Note. The parts in the No. OO and No. O Outfits are not intended for use with the larger Outfits.

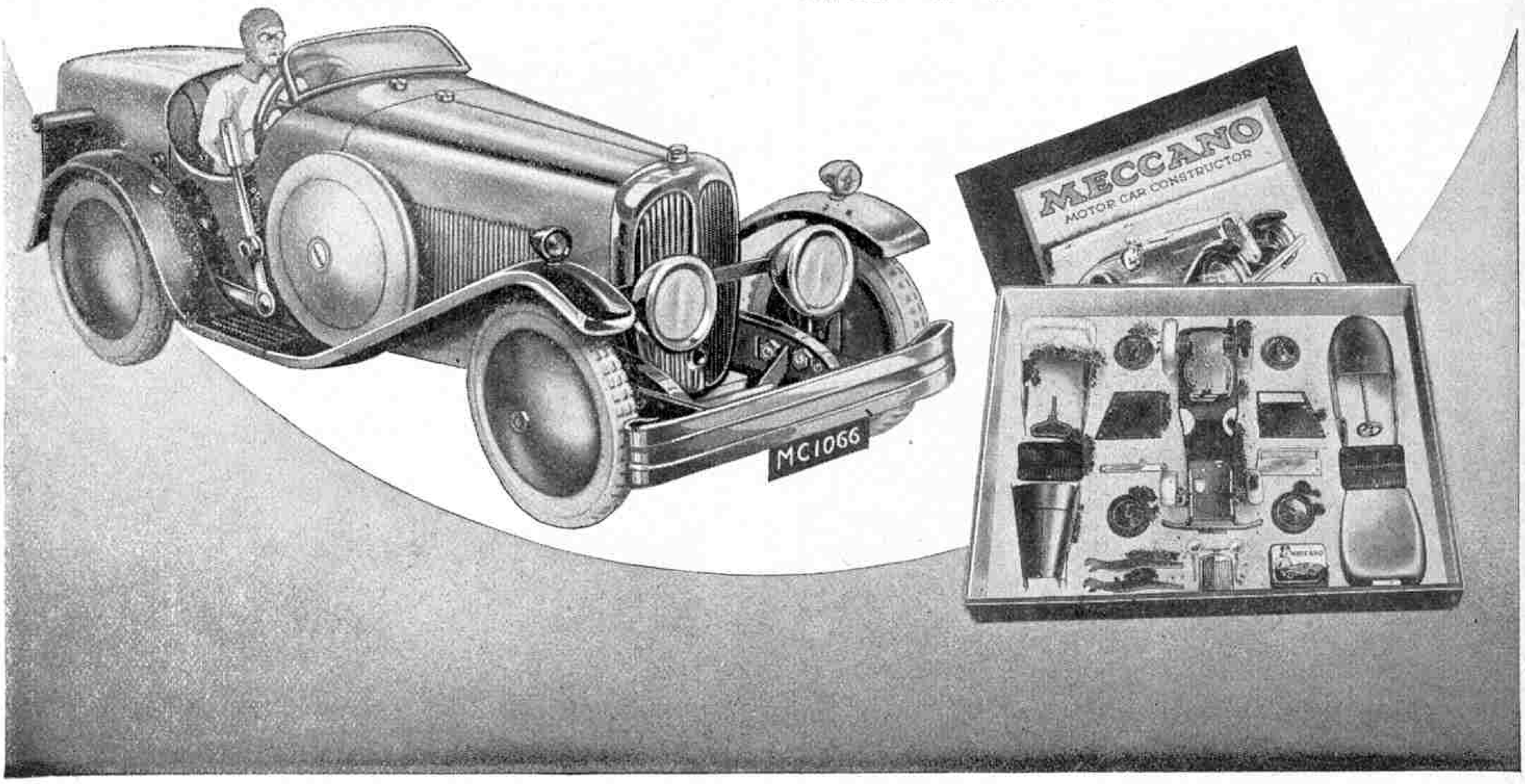
MOTOR CAR CONSTRUCTOR OUTFITS

Now is the time to get a Meccano Motor Car Outfit. You will never grow tired of building and running the superb models that you will be able to build. Your days will be full of fun and thrills!

Perfect miniature reproductions of many different types of car can be built with these splendid Outfits, and a powerful clockwork motor, that gives the models a long run on one winding, is included in each Outfit.

Prices of Motor Car Outfits

No. 1 Outfit	9/6	No. 2 Outfit	18/9



MECCANO LIMITED, BINNS ROAD, LIVERPOOL 13

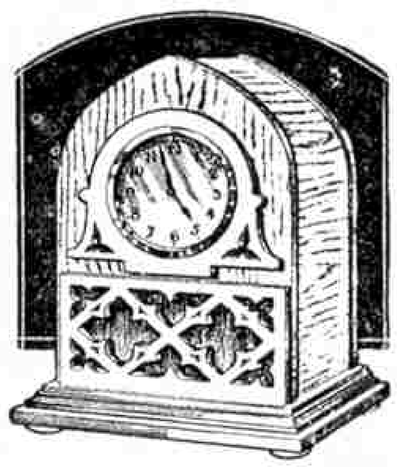
Make them all with a HOBBIES FRETWORK SET

A jolly fine hobby for any boy. Making all sorts of useful things in wood—to give away, to use at home, or to sell. Pleasure and profit in your spare time. Any Hobbies Outfit provides all the necessary tools and you can start right away. Free illustrated lists and a specimen copy of Hobbies Weekly on request.

MODEL GALLEONS

Anyone can cut out and make a marvellous range of these popular ships. Design, instructions and all materials supplied. Write for free leaflet about them, as below.

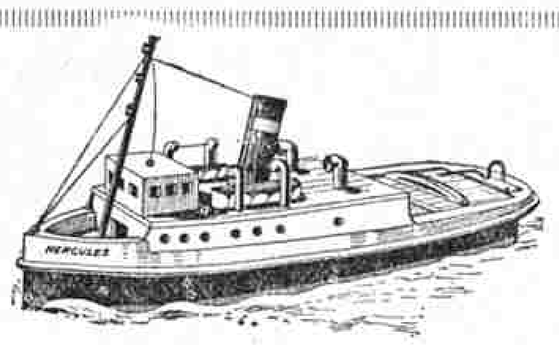
Hundreds of things a boy can make



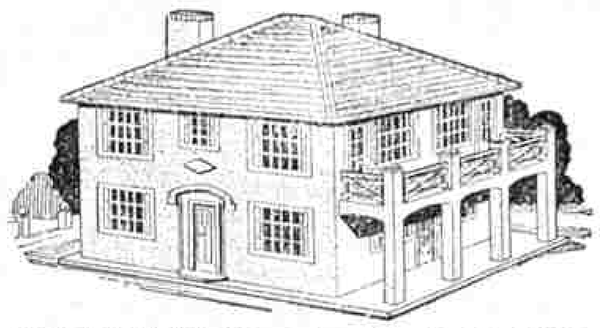
MAKE A CLOCK

There are all kinds of clocks you can make from Big Ben model to small mantel clocks. This is from Design pattern No. 2128 supplied full size.

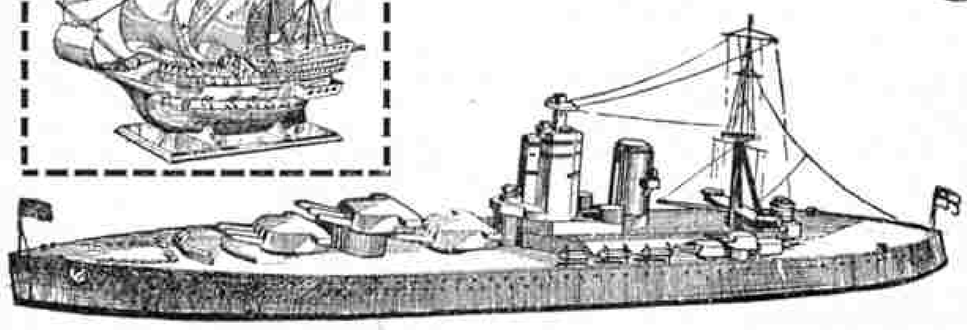
Complete Sets from 1'6 to 25'- Ask for a free list as below



A little Model Tug you can make. Driven by flashlamp battery. Full size design (No. 2129) and all materials supplied. Quite simple and cheap to make.



A Modern Doll's House from Design No. 2151. Hinged back and front, full size patterns and complete instructions provided. Stands 2 ft. 6 ins. wide and 18 ins. high.



Make a model of H.M.S. Nelson. In wood from full size patterns (No. 2107). Stands 1 ft. 7 ins. long. Simple to make from complete instructions. A realistic model anyone can make with a fretsaw.

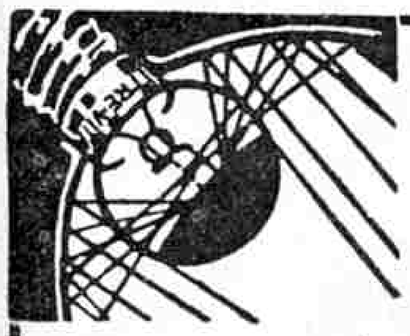
Of all leading Ironmongers, Stores or Hobbies own Branches. Orders by post to Dept. 96, Hobbies Ltd., Dereham, Norfolk.

Paddle Steamer Design Free

Large pattern sheet for Big Ben model and an electrically driven Paddle Steamer free with Hobbies Handbook for 1939. Nearly 1000 things to make. 284 pages. No other book like it. Only 6d. from any newsagent or 9d. post free from Hobbies.

GET YOUR COPY TO-DAY

FREE DESIGNS WITH EVERY ISSUE OF HOBBIES WEEKLY



NO WASTED LIGHT

TRE VITA DOUBLE REFLECTOR BULBS OF AMAZING BRILLIANCY

TRY THIS SIMPLE TEST

Here is a means of obtaining a really brilliant light using no more current. Consider how, when an ordinary cycle bulb is connected to a battery without a reflector, the short distance the rays travel, thereby proving the rays need your reflector to make the forward beam. Then consider how the whole of those rays which do not reach your reflector are lost, and you will realise why Double Reflector Bulbs, which throw these rays back upon your reflector, give you a "Light of Amazing Brilliancy."

DYNAMO HEAD LAMP BULBS
With 15 mm. Double Reflector Balloons and M.E.S. Caps.

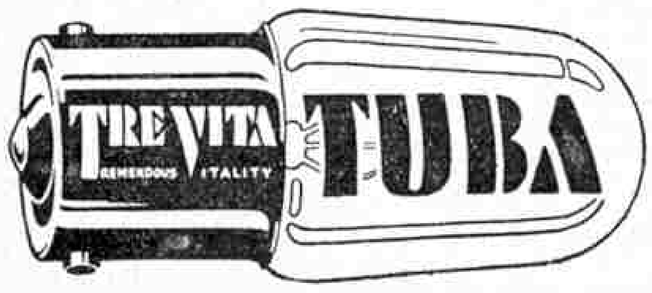
Ref.	Volts.	Amps.	Watts.	Price.
751	4	.3	1.2	7½d.
752	4	.35	1.4	7½d.
753	4.5	.3	1.35	7½d.
754	4.5	.35	1.575	7½d.
755	4.5	.4	1.8	7½d.
759	6	.25	1.5	7½d.
760	6	.3	1.8	7½d.
761	6	.35	2.1	7½d.
762	6	.4	2.4	7½d.
763	6	.45	2.7	7½d.
764	6	.5	3	7½d.
765	6	.55	3.3	7½d.
770	Special Bulb for Lucifer 6V. 12-Pole			7½d.

BATTERY HEAD LAMP BULBS

Ref.	Rating.	For Use with	Balloon	Price
140	2.5V. 0.3A.	One Large Twin Cell	11½mm.	6d.
141	2.5V. 0.3A.	Cycle Lamp or Torch	15 mm.	6d.
142	3.8V. 0.3A.	One Normal 3-Cell	11½mm.	6d.
143	3.8V. 0.3A.	or one Box 3-Cell Cycle Lamp or Torch	15 mm.	6d.
144	5.5V. 0.3A.	Two Large Twin Cell Cycle Lamp or Torch	15 mm.	7½d.
145	8V. .15A.	Two Normal 3-Cell Cycle Lamp or Torch	15 mm.	7½d.

British Made Throughout.
Every Bulb supplied Individually Guaranteed.

THE TRE VITA IMPROVEMENT



in BAYONET CAPPED BULBS for LUCAS, MILLER, SEECO, etc. Also supplied for Sturmey Archer when the main advantage consists of "Increased Life Efficiency" due to the greater vacuum space within the balloon.
Silk Frosted 1/-
Clear 11d.

Obtainable from Halfords and all Leading Cycle Dealers or Post Free Direct. Catalogues Post Free.

VITALITY BULBS (Props.: Wartburg Lamps Ltd.) **RYLAND ROAD LONDON, N.W.6**

Milbro locos are real—

PURCHASE IN CONFIDENCE

Whether you are interested in locomotives only or complete railways you can be certain that Milbro products will give you the same utterly reliable service that is expected of the great railway groups in this country. Send 6d. for your copy of the 100 page catalogue to

THEY look the same, run with identical reliability and are built to the same fine standards as the huge expresses that maintain such efficient schedules throughout the country.

MILBRO *TRUE-TO-SCALE replicas for reliability*

MILLS BROS. (Model Engineers) LTD.
St. Mary's Road, SHEFFIELD

London Showrooms:
2, Victoria Colonnade, Victoria House, Southampton Row, W.C.1

PERFECT SCALE MODELS

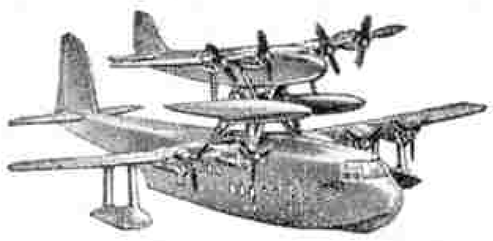
DINKY TOYS

OVER 300 VARIETIES

Collecting Dinky Toys is one of the most fascinating of all hobbies. These realistic miniatures are unique in their rich colouring and perfection of design and finish, and their range is so wide as to appeal to all tastes. This season many new items have been introduced including scale models of the latest types of Aeroplanes, notable among which is a wonderful model of the Mayo Composite Aircraft.

Every boy or girl who has not already done so should start this delightful collecting hobby to-day. All the models can be purchased either separately or in complete sets.

MAYO COMPOSITE AIRCRAFT



Dinky Toys No. 63

Scale model of the Mayo Composite Aircraft. Price **2/-** each

The components of the above can be purchased separately.

No. 63a Maia Flying Boat ... **1/3** each
No. 63b Mercury Seaplane ... **9d.** each

Ready during January.

FLYING BOAT "CLIPPER III"

Dinky Toys No. 60w

Scale model of the Pan American Airways flying boat that took part in the transatlantic experimental flights in 1937

Price **1/-** each

ARMSTRONG WHITWORTH "WHITLEY" BOMBER

Dinky Toys No. 60v

Scale model of the "Whitley" long-range heavy bomber adopted by the R.A.F. Price **9d.** each

ARMSTRONG WHITWORTH "WHITLEY" BOMBER

(With Shadow Shading) Dinky Toys No. 62t

Similar to Dinky Toys No. 60v but with Air Ministry Shadow Shading. Price **11d.** each

Ready during January.

IMPERIAL AIRWAYS LINER "FROBISHER"

Dinky Toys No. 62w

Scale model of the first of the Imperial Airways "Frobisher" class air liners. Price **10d.** each

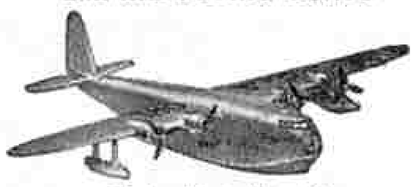
DE HAVILLAND "ALBATROSS" MAIL LINER

Dinky Toys No. 62r

Scale model of one of the "Albatross" mail liners built for the Air Ministry for experimental flights.

Ready during January. Price **10d.** each

EMPIRE FLYING BOATS



Dinky Toys No. 60r

Scale models of the famous Imperial Airways Flying Boats. Twelve models available named: *"Caledonia," "Canopus," "Corsair," "Challenger," "Centurion," "Cambria," "Capella," "Ceres," "Clio," "Calypso," "Corinna"* and *"Cheviot."* Price **1/-** each

ATLANTIC FLYING BOAT

Dinky Toys No. 60x

Similar in type to the Empire Flying Boat. Assorted colours. Price **1/-** each

AIRSPEED "ENVOY" MONOPLANE

Dinky Toys No. 62m

Scale model of the Airspeed "Envoy" twin-engined commercial monoplane. Assorted colours. Price **6d.** each

THE KING'S AEROPLANE

Dinky Toys No. 62k

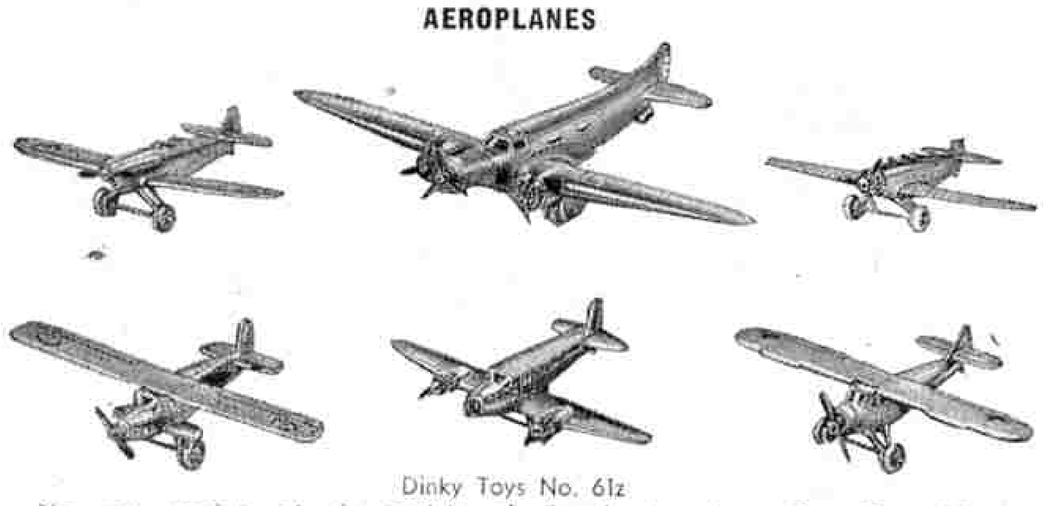
Scale model of the Airspeed "Envoy" supplied to the Air Council for the King's Flight. Price **8d.** each

IMPORTANT TO READERS

Do not pay more for Dinky Toys than the prices quoted in these pages.

Some readers, on responding to advertisements in a contemporary, have been supplied with Dinky Toys model aeroplanes at prices much in excess of the makers' prices. Readers who respond to such advertisements are strongly advised to make enquiries of the advertisers as to the make of the model aeroplanes before making their purchases.

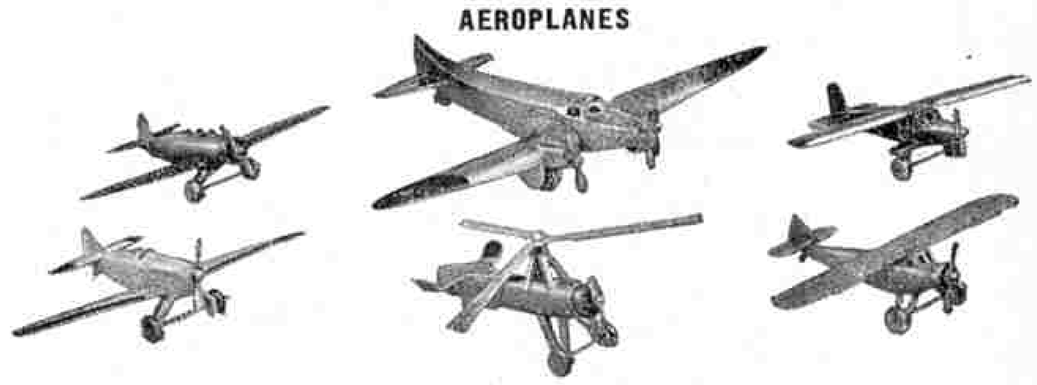
AEROPLANES



Dinky Toys No. 61z

This set consists of six models of French Aeroplanes—Dewoitine 338, Dewoitine 500d, Potez 58, Potez 56, Hanriot H180M and Farman F360. (Made in the Meccano Factory in Paris.) Price **3/-**

AEROPLANES



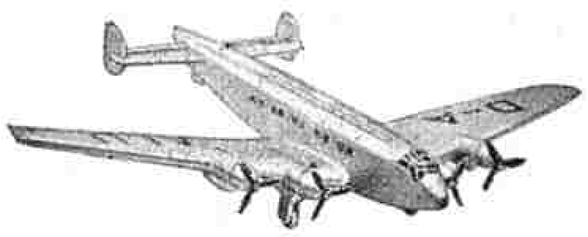
Dinky Toys No. 60z

The set consists of six models of famous French aeroplanes—"Arc-en-Ciel," Potez 58, Hanriot H180T, Breguet-Corsaire low wing monoplane, Dewoitine 500 and Cierva Autogiro. (Made in the Meccano Factory in Paris.) Price **3/-**

MONOPLANE "ARC-EN-CIEL." Dinky Toys No. 60az

A scale model of the famous French triple-engined monoplane "Arc-en-Ciel." (Made in the Meccano Factory in Paris.) Price **9d.** each

JUNKERS Ju 90 AIR LINER



Dinky Toys No. 62n

Scale model of the latest type of German air liner, having a top speed of 256 m.p.h. Price **11d.** each

DOUGLAS D.C.3 AIR LINER

Dinky Toys No. 60t

A scale model of a Douglas D.C.3 air liner, a type in regular service on American and European routes. Price **9d.** each

ARMSTRONG WHITWORTH "ENSIGN" AIR LINER

Dinky Toys No. 62p

Scale model of the largest British air liner. Six models available, named: *"Ensign," "Elsinore," "Explorer," "Echo," "Ettrick"* and *"Elysian."* Price **1/-** each

Ready during January.

REFUELLING TENDER

Dinky Toys No. 60y

Realistic model of Thompson Bros. Tender used for refuelling aeroplanes at aerodromes. Price **8d.** each

MECCANO LIMITED — BINNS ROAD — LIVERPOOL 13

A FASCINATING COLLECTING HOBBY

DINKY TOYS

FINISHED IN RICH COLOURS

"THUNDERBOLT" SPEED CAR

Dinky Toys No. 23m
A fine scale model of the car in which Capt. G. E. T. Eyston set up a world land speed record of 357.50 m.p.h. at Bonneville, Utah, U.S.A. Price **1/-** each

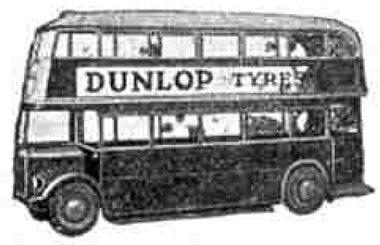
SIX-WHEELED WAGON

Dinky Toys No. 25s
An interesting model of a modern three-ton wagon. In assorted colours.
Price **1/-** each

TAXI WITH DRIVER

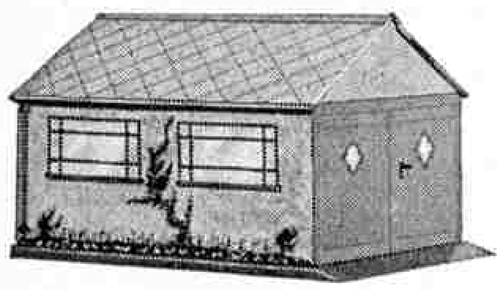
Dinky Toys No. 36g
Fitted with detachable rubber tyres.
Price **11d.** each

DOUBLE DECKER BUS



Dinky Toys No. 29c
Assorted colours. Fitted with detachable rubber tyres.
Price **1/-** each

GARAGE



Dinky Toys No. 45
Fitted with opening double doors. Will accommodate any two Dinky Toys Motor Cars.
Price **1/3** each

POLICE MOTOR CYCLIST

Dinky Toys No. 37b

Price **6d.** each

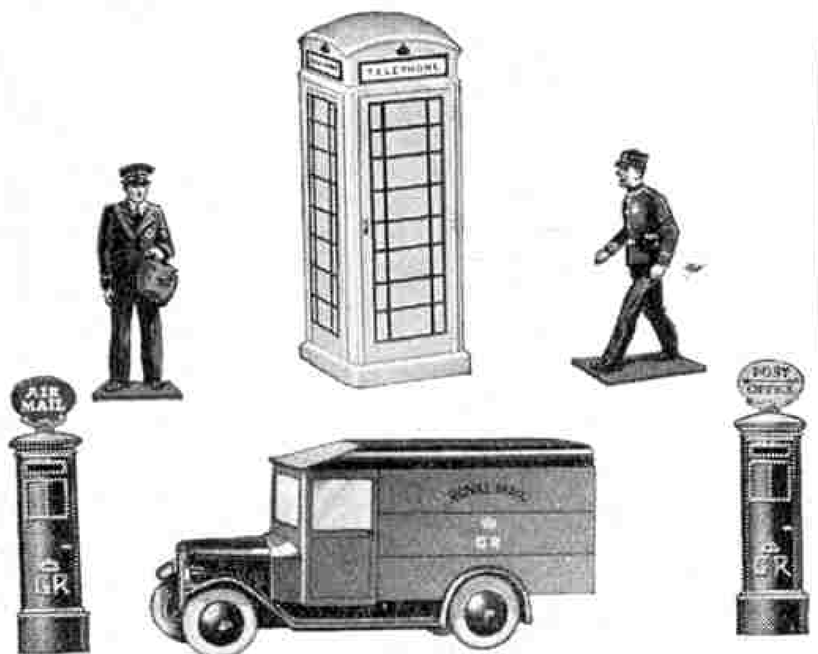
CIVILIAN MOTOR CYCLIST

Dinky Toys No. 37a

Assorted colours. Price **6d.** each

Royal Corps of Signals Despatch Rider. Dinky Toys No. 37c
Similar to Dinky Toys No. 37b. Finished in correct colours. Fitted with solid rubber wheels. Price **6d.** each

POSTAL SET

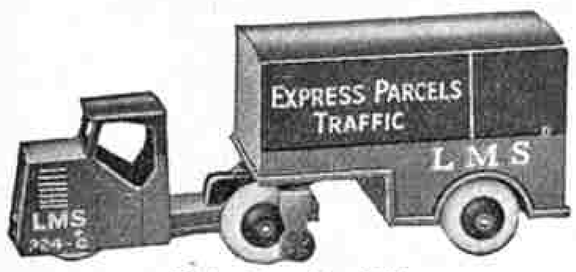


Dinky Toys No. 12

No. 12a	Pillar Box, G.P.O.	each	**3d.**
No. 12b	„ „ Air Mail	„	**3d.**
No. 12c	Telephone Call Box	„	**4d.**
No. 12d	Telegraph Messenger	„	**3d.**
No. 12e	Postman	„	**3d.**
No. 34b	Royal Mail Van	„	**10d.**

Price of complete set **2/3**

RAILWAY MECHANICAL HORSE AND TRAILER VAN

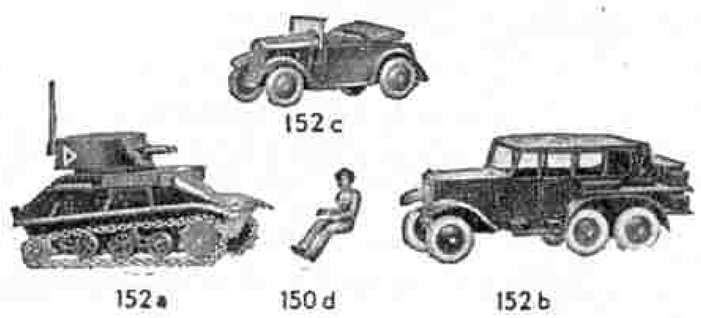


Dinky Toys No. 33R
Fitted with detachable rubber tyres.

No. 33Ra	Railway Mechanical Horse	each **8d.**
No. 33Rd	Trailer Van	„ **10d.**

Price, complete, L.M.S.R., L.N.E.R., G.W.R. or S.R. ... **1/6**

ROYAL TANK CORPS LIGHT TANK SET



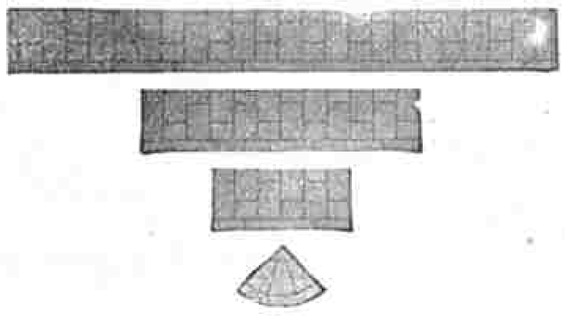
152c 152a 150d 152b

Dinky Toys No. 152

No. 152a	Light Tank (4½ tons, 25 h.p.) ...	... each	**1/2**
No. 152b	Reconnaissance Car	... „	**1/-**
No. 152c	Austin Seven Car	... „	**4d.**
No. 150d	Driver	... „	**3d.**

Price of complete set **2/9**

PAVEMENT SET



Dinky Toys No. 46
The contents of this set are four 3 in., six 6 in. and four 12 in. strips of pavement and four quarter discs for corners. Price of complete set **6d.**

SMALL CARS

Dinky Toys No. 35 Fitted with solid rubber wheels.
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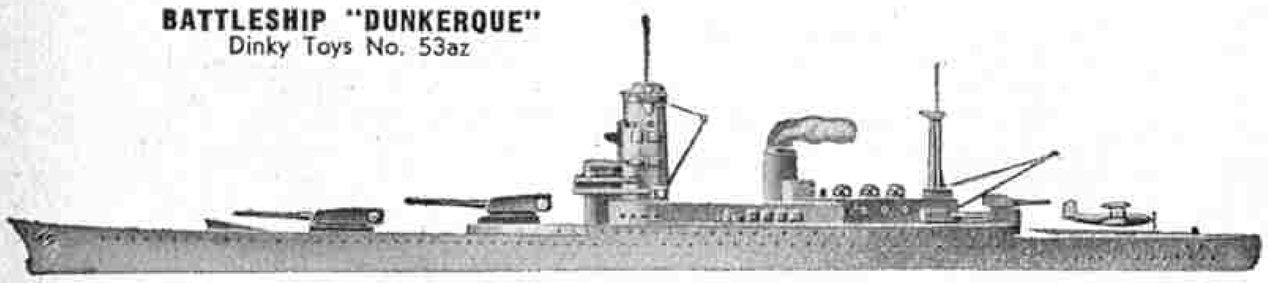
Dinky Toys No. 35d

This model is the same as No. 152c, illustrated above, except that it is finished in a range of different colours. Price **4d.** each.

BATTLESHIP "DUNKERQUE"

Dinky Toys No. 53az



Scale model of the French 26,500 ton Battleship *"Dunkerque,"* which has an overall length of 702 ft. **9 in.**, and a main armament of eight 13 in. guns. Price **9d.** each
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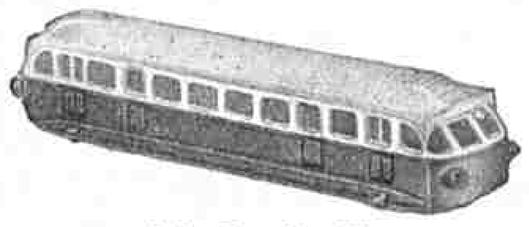

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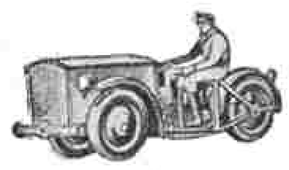

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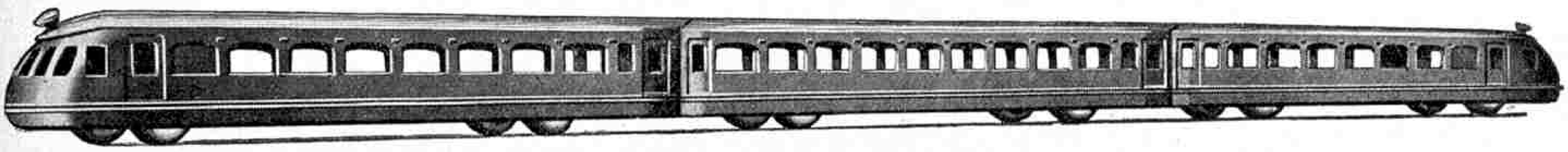

Dinky Toys No. 16z Price **1/6** each (Made in the Meccano Factory in Paris.)

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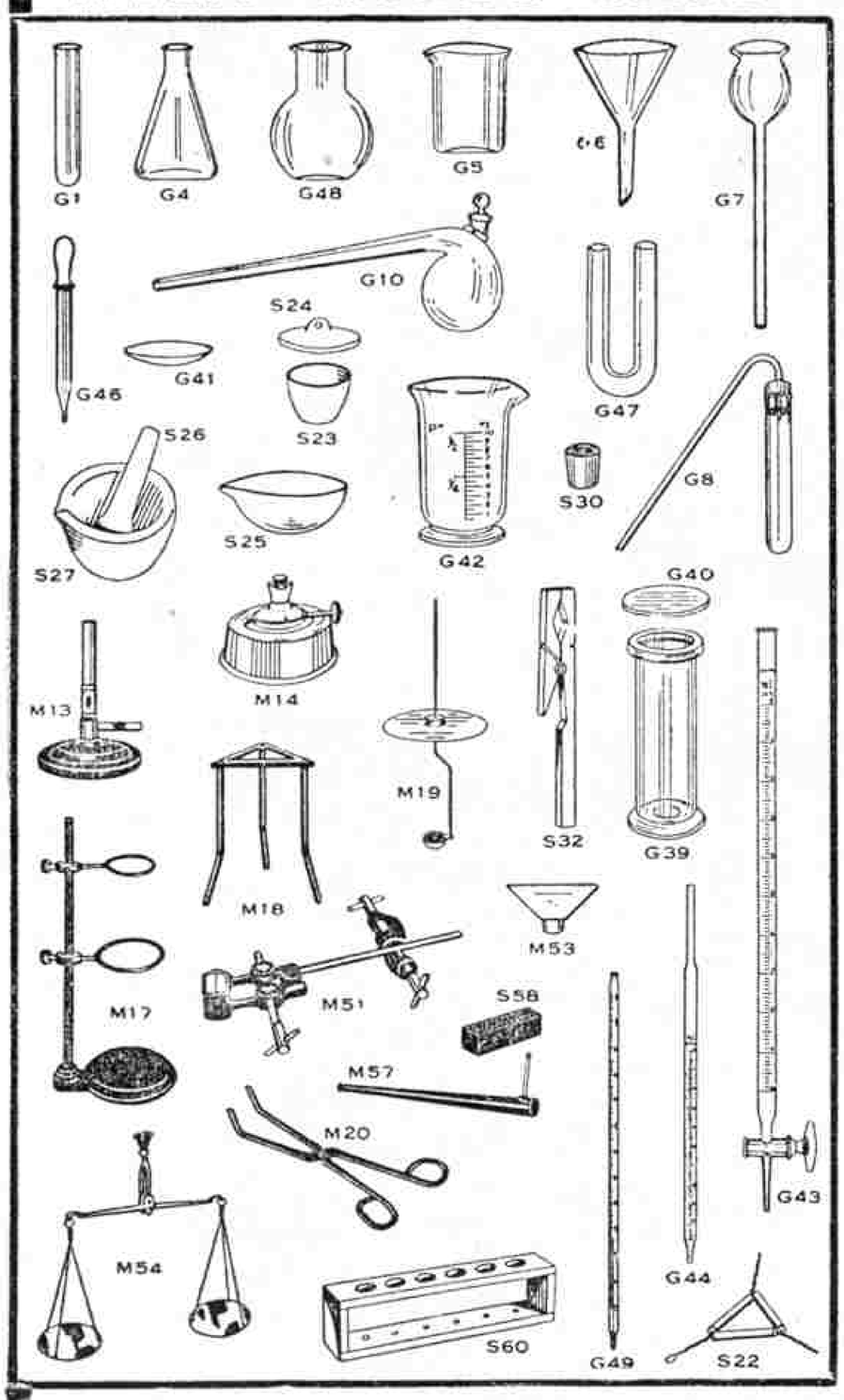

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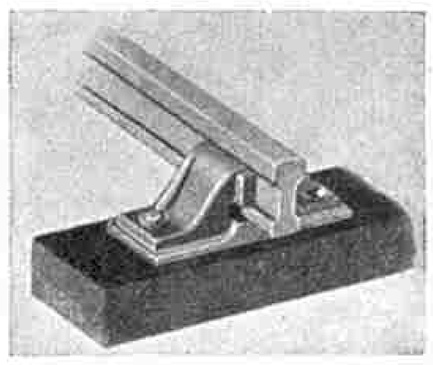

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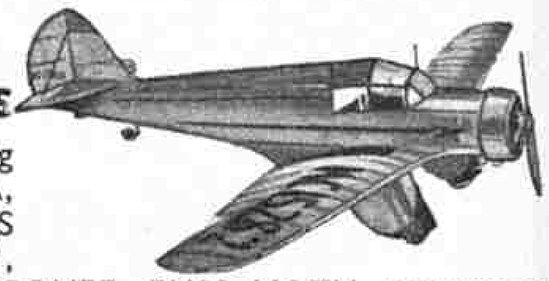

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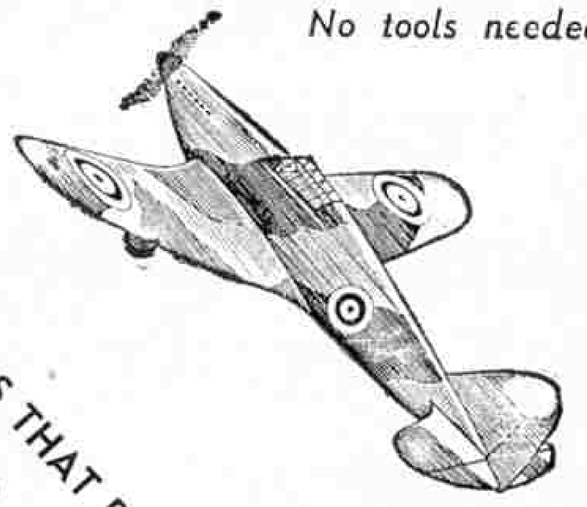

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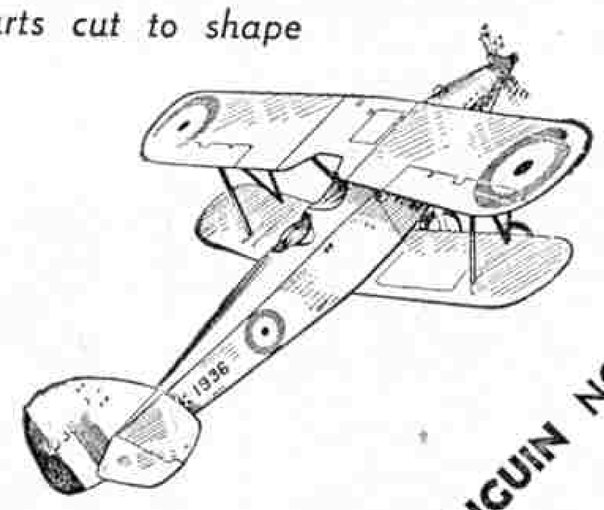

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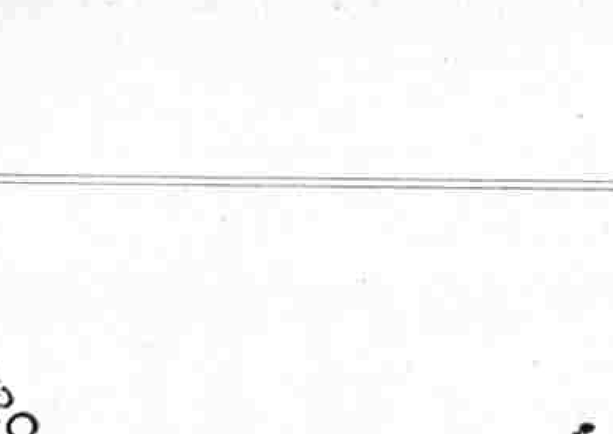

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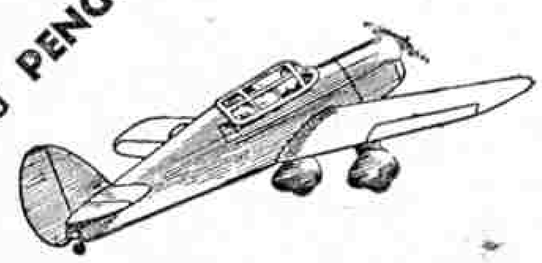

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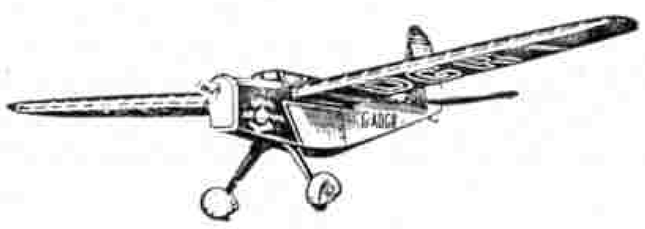
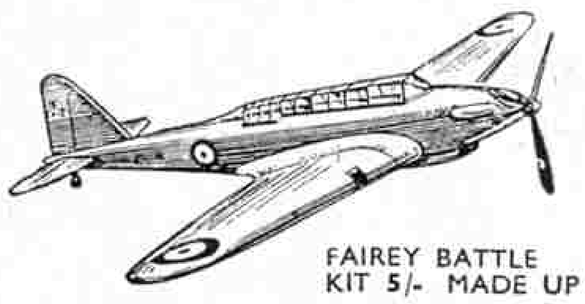


MAIL PLANE 10/6



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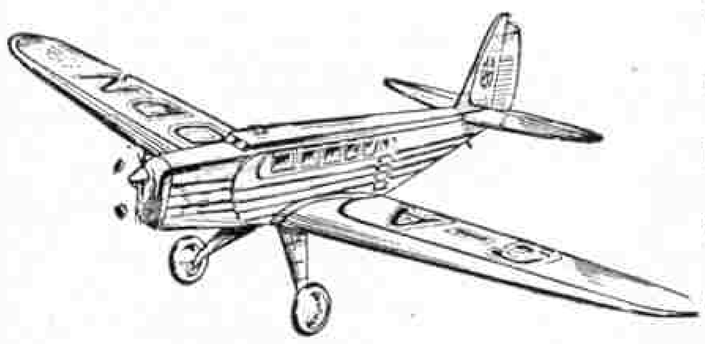

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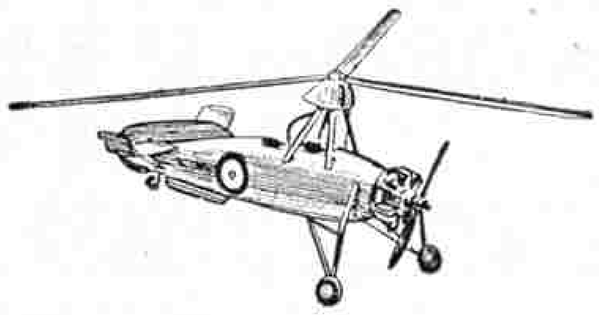

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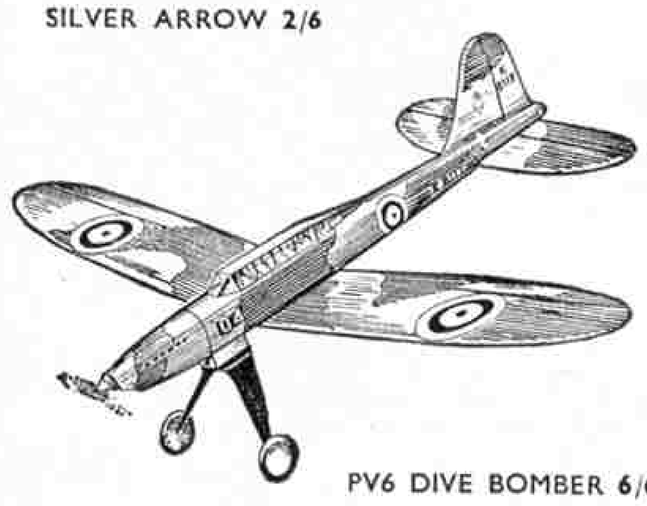

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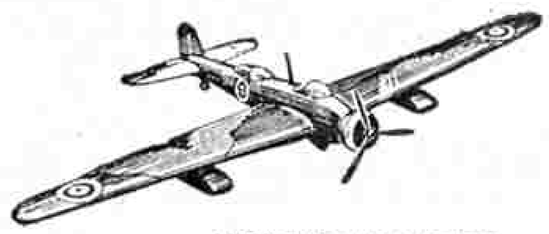

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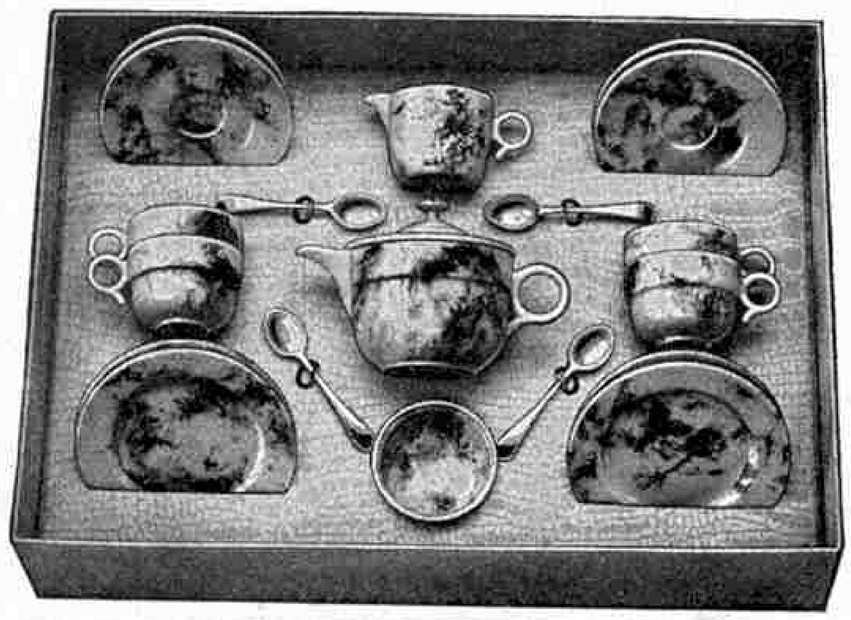

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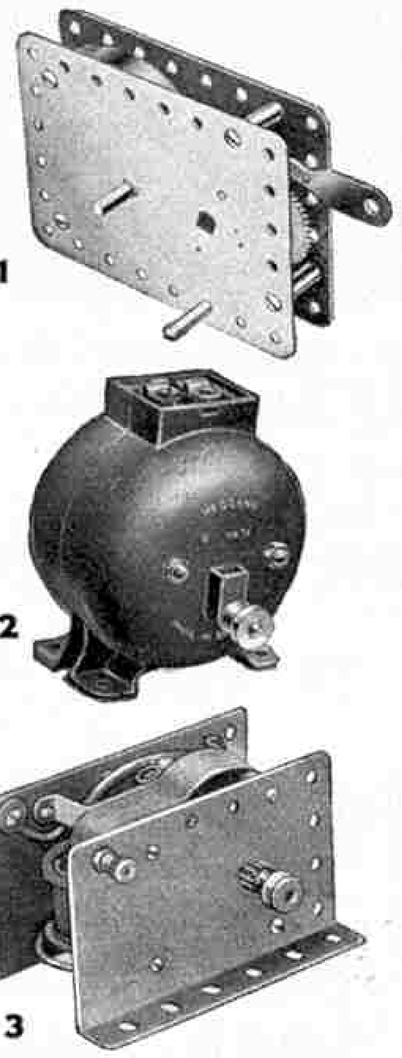

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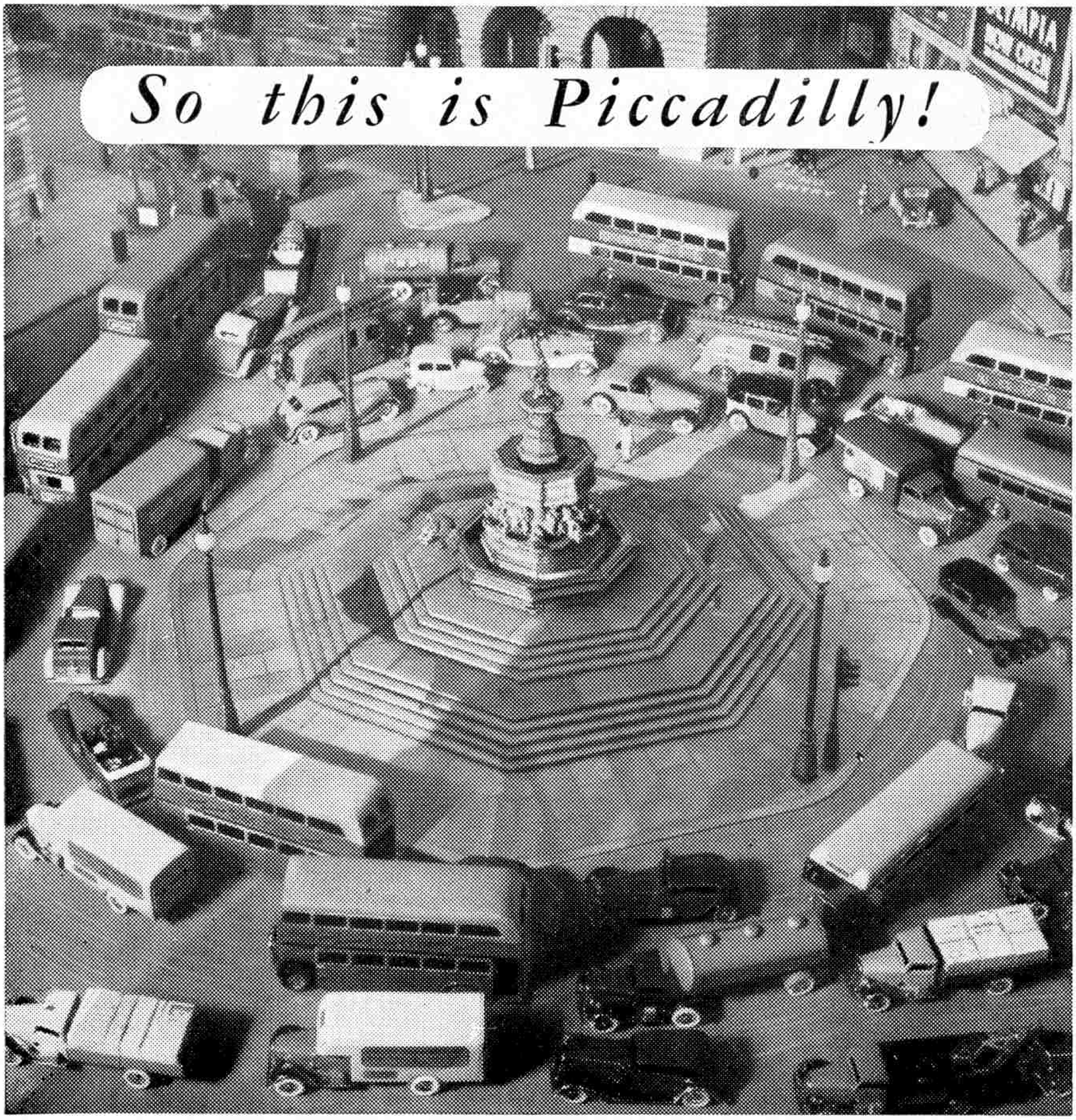

AND A VERY REALISTIC SCENE, TOO! But how many of you have realised that every vehicle in the photograph is actually a clockwork TRI-ANG MINIC MODEL? It does show how true-to-scale these models are. And every detail is correct, too! The collection shewn here gives also some idea of the range of models that are made—from fire engines to Municipal Dust Carts—from the popular 'baby' to the lordly Rolls Royce, they're all there. And there are also Fire Stations, Garages, etc.

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BEST WISHES FOR 1939 TO ALL MY READERS—FROM THE EDITOR

MECCANO MAGAZINE

Editorial Office:
Binns Road, Liverpool 13
England

Vol. XXIV. No. 1
January 1939

With the Editor

The New Year Spirit

My first task this month, and a very pleasant one, is to thank all those readers who have so kindly sent me their good wishes for Christmas and the New Year. The close contact between Editor and readers that has always been such a striking feature of the Magazine is never more in evidence than at this season, but I have been surprised by the volume of the expressions of goodwill that have reached me this year. A particularly pleasant feature has been the chorus of praise for the special Christmas issue, which was enlarged to 116 pages, although there was no increase in price. The encouragement that so many letters of appreciation have given me is ample reward for the extra work that falls upon myself and my staff in preparing this issue.

This month we begin a new volume, the 24th, and I can promise readers that the high standard of previous volumes will be fully maintained and even surpassed. I shall be greatly assisted in this task if readers will co-operate with me. They can do this in two particularly effective ways. One is to write to me regularly to tell me what they think of each issue, and what kind of articles they would like me to give them. The other is to see that their friends become readers too, and I want every "*M.M.*" enthusiast to make a New Year resolution that he will get at least one new reader.

The Year in the Air

Naturally at this time of the year we look back over the happenings of the past twelve months, partly to take stock, and partly as a means of thinking out what the future may have in store for us.

The old international rivalry in the air is still in existence, and during the past twelve months records made by the airmen of one country have been wrested from them by those of another. A good example of this is the long-distance flight record made in November in two Vickers "Wellesley" monoplanes by men of the Long Range Development Unit of the R.A.F., who flew 7,162 miles from Egypt to Australia and thus beat by 856 miles the previous record held by the Russian airmen who in 1937 flew from Moscow to California.

Although one world record was regained from Great Britain by this great flight, another was lost when the Italian pilot Lieut. Col. Mario Pezzi reached the height of 56,017 ft., 2,080 ft. higher than the British record created earlier in the year by the late Squadron Leader M. J. Adam.

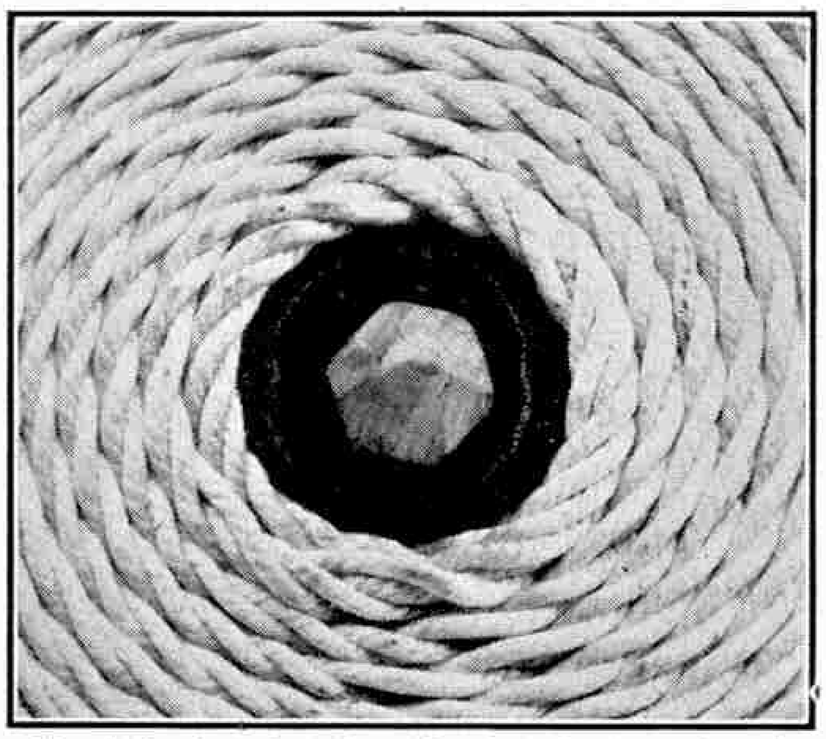
In addition to these outstanding achievements there were many flights of great merit, including one across the Atlantic and another to South Africa by "Mercury," the seaplane that is catapulted from a flying boat in mid-air in order to enable it to begin a flight with a load greater than it can take off with. By way of comic relief to the great flights of the year there was the transatlantic crossing by Douglas Corrigan, who asserted that he had set off eastward from New York by mistake!

Records on Land and Water

Two world records also were being made on water during 1938, both of them by British boats. The first was a speed record, Sir Malcolm Campbell raising this from 129.4 m.p.h., his own previous best achievement, to 130.91 m.p.h. In the same month the second record was created by the launch of the largest ship ever built at Clydebank. This was the "*Queen Elizabeth*," which has a length of 1,030 ft. and will have a gross tonnage of about 85,000. Earlier in the year the new "*Mauretania*," the largest ship ever built in an English shipyard, had been launched.

After more than 100 years of railways it might be expected that there would be few records to be made in this sphere. Yet the past year saw the creation of a new speed record, when "*Mallard*," an L.N.E.R. streamlined "Pacific," reached 126 m.p.h. with a streamlined train behind it.

WHATEVER IS IT? No. 1



Here is the first of another series of puzzle pictures, in which ordinary things that one may see every day are shown from unusual angles. To the first reader who can tell me what this mysterious photograph represents I will send a copy of my book "The Modern Book of Engineering."

Solutions should be written on postcards only, and addressed "Editorial Competition No. 1," "Meccano Magazine," Binns Road, Liverpool 13. Closing date 31st January.

Television at Work

The Marvel of "Seeing at a Distance"

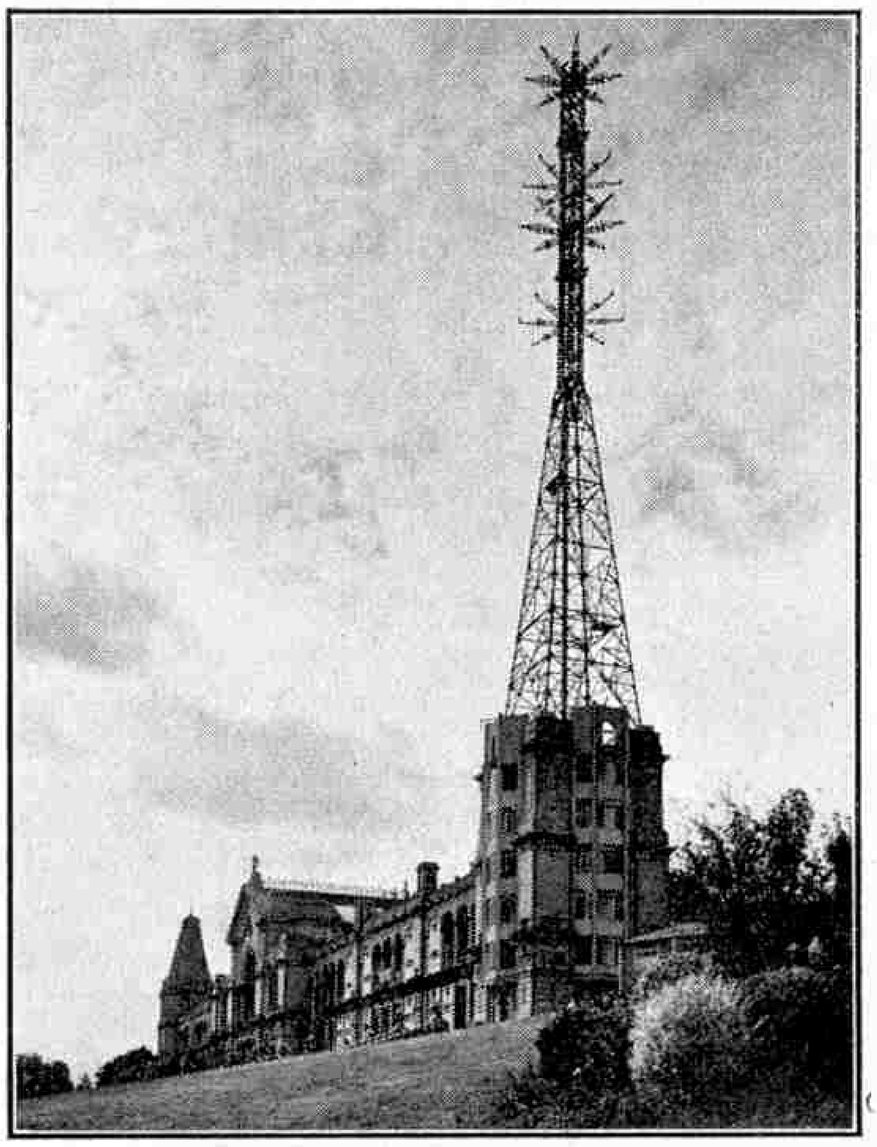
By T. R. Robinson

THE television transmissions of the British Broadcasting Corporation are rapidly making "seeing at a distance" so familiar that the atmosphere of novelty which surrounded the early experiments is being replaced by a keen interest in the invention as a new source of entertainment. At the same time, television is perhaps the most wonderful of modern inventions, and is a thing that men have dreamed of for centuries.

As with so many wonderful things that we use to-day, the general principles are fairly simple, although the apparatus necessary for the transmission of programmes is rather complex. This is due largely to differences between broadcasting a picture and transmitting speech or music. With the latter the waves can be sent as a mixture of tones all at the same time, because that is the way the ear itself takes note of them when listening. To transmit all the various tones, or depths of light and shade, in a picture in the same manner would only lead to a meaningless jumble, however, because each would have to be picked out and placed in its proper position before the eye could make anything of the scene presented to it.

In television therefore each tiny detail of the view transmitted must be handled separately. This cannot be done by providing a separate transmitter for each, for even a tiny picture would then require thousands of transmitters, and of course thousands of receivers. Instead the details of the picture are sent out in turn. The camera that captures the scene sweeps its eye across it line by line at very high speed, each line below the one before it, until every part of the scene has been looked at, and then the process begins all over again. Thus the picture is broken up into little bits, each with its appropriate tone, and a similar arrangement at the other end reproduces these and builds them up line by line until the picture again appears. This is done so rapidly that the eye does not lose its vision of the first of these bits to appear on the screen of the receiver before the last one has come into position, and the observer therefore sees the entire picture at once—or at any rate he thinks he does. Breaking up the picture in this manner into lines, each consisting of a succession of tiny areas, and picking these out in order line by line is known as "scanning."

In the earlier forms of television, this scanning was attempted by mechanical means, but in the system now used the work is done electrically. It is of course of the utmost importance that the scanning at both transmitting and receiving ends keeps in perfect step if a perfect picture is to be seen at the latter, and it was here that most of the early difficulties were found. In the Marconi-E.M.I. system, now used by the B.B.C., a cathode-ray tube is employed for both transmission and reception. This is simply a glass tube of special shape with two electrodes in it. A very high voltage is applied to the tube and from the negative electrode, or cathode, a stream of electrons is then shot out in a beam. These electrons form the cathode rays, and electro-magnets cause the beam to move from side to side, and also up and down, so as to "scan" an image of scene that is to be televised. This image is focussed on a special screen in the cathode-ray tube itself.



The mast and aerials at the B.B.C. television transmitting station, Alexandra Palace. The illustrations to this article are reproduced by courtesy of the B.B.C.

One of the technical difficulties of television is that it calls for a much wider band of frequencies or electrical vibrations than will serve for the transmission of music. In television, the band ranges from one vibration in many seconds to about 2,500,000 vibrations in each second, and if such large variations are to be transmitted successfully a very short wavelength must be employed for the transmitter. The carrier-wave of the London Television Station has a frequency of 45,000,000 vibrations per second, corresponding to a wavelength of about 6.7 metres. This in itself, is no disadvantage, but the use of such a short wavelength limits the radius of transmission to about 30 miles under average conditions.

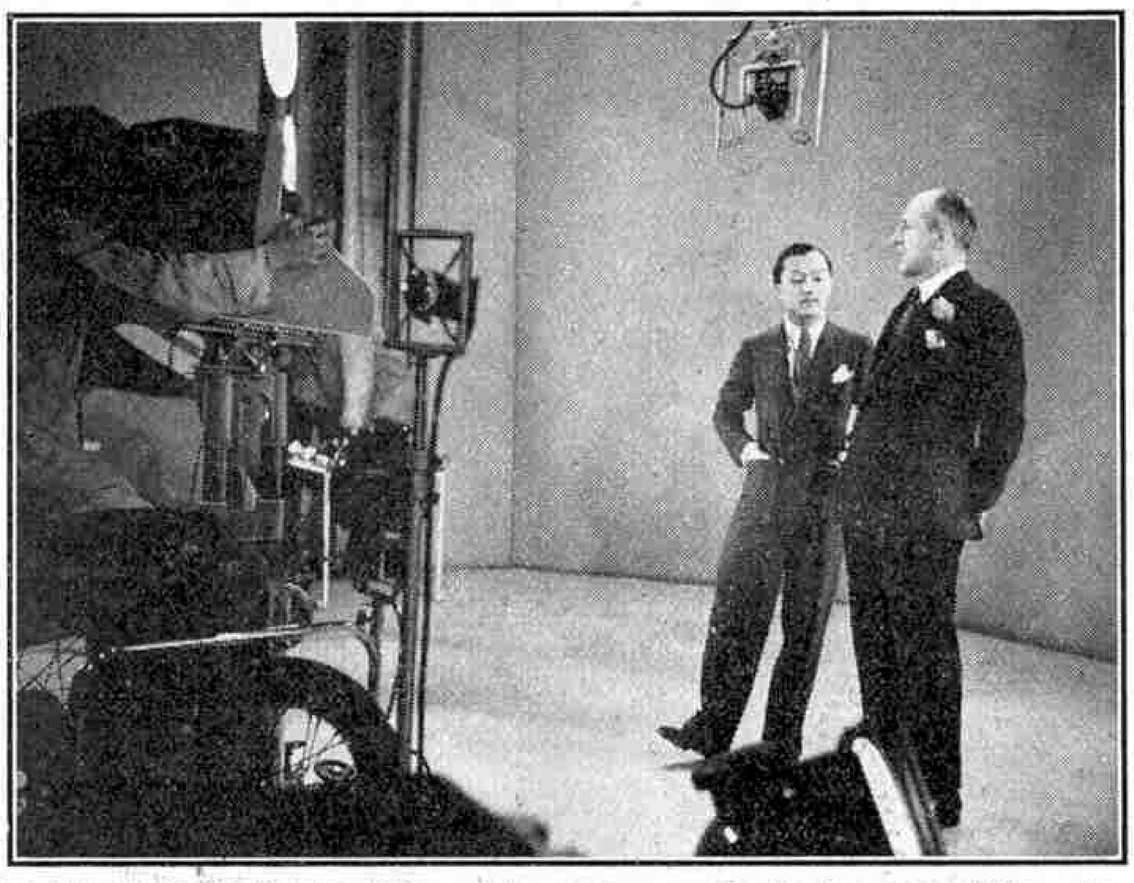
Despite this, rapid progress has followed the opening of the London Television Station at Alexandra Palace, and it seems likely that before long all other big centres will have their own television transmitters, which will serve them in much the same way that the sound transmitters do at the present time.

At the London station, one tower of the Alexandra Palace has been reconstructed to provide studios, control rooms and a transmitter hall, and above the tower has been erected the special mast which is now such a landmark in North London. This mast is of rather unusual design, and carries both the "vision" and "sound" transmission aerials. The two are separate and distinct, the former being the higher. The aerials are carried vertically on a series of radial arms, and the whole mast rises to a height of 300 ft. above the ground level. The wind pressure on the mast is very great in stormy weather, and so at each corner of the tower the foot of the mast is attached to a 17-ton block of concrete.

The transmitters for vision and sound are somewhat

similar in general appearance to the more ordinary broadcasting transmitters. There is a control desk in front of the transmission equipment, and television receiver-screens are fitted both to this and to the transmitters so that the engineer can keep an eye on the picture and so check the operation.

The studios and control room adjoin, so that a large observation window in the wall between them enables the producer and the engineers to see the whole of the interior of the studio in use. The studios resemble those used for cinematograph work, and each has two stages, equipped with curtains and with spot-lights and floodlights of great power. The lamps are mounted above the stages, but additional plug-in sockets are provided for extra illumination by portable lamps. Pre-selective switching and dimming control are fitted, and the illumination is sufficiently flexible to deal with any dramatic conditions called for by the usual type of production.



H.R.H. Prince Birabongse of Siam, better known as "B. Bira," and Lord Howe, the racing motor drivers, before the television camera in a studio at Alexandra Palace.

Several cameras are used in the "shooting" of a transmission, and one of these is specially mounted on a pneumatic-tyred truck that can be moved up to give close-ups and what are called "dolly-shots," in which the camera moves to and from the scene whilst the transmission is in progress. The other cameras are mounted on tripods, and one or two are used for the shooting of captions or titles as well as for actual scenes.

A title for a television item is usually painted on cardboard, and an interesting point in this transmission is that by altering the way in which the output of the camera is fed to the amplifiers, the same title can be made to appear as a "positive" or a "negative" on the receiver screen. The changing or "fading" from title to picture and from scene to scene is controlled by the producer, who from his viewing gallery can survey the whole process of putting over the programme. The cameramen wear headphones, and receive instructions from the producer, who tells them when to move up and places them as he requires before fading in the particular camera concerned.

The television camera "looking" at the engine of a car during the 1938 Motor Show.

In addition to being able to see the actual stage, the producer has a viewing or "monitoring" screen on which he can see what is being transmitted, and there is a further screen in the studio, so that the staff there can keep in touch with the output scene. It is very interesting to watch an item such as a play in progress, for the actual acting and the television image can be looked at side by side.

Modern transmissions are possible without any freak make-up on the part of the players, but to avoid what photographers know as "halation" white articles, such as cloths, shirt-fronts and so on, are converted to what is known as "off-white," a sort of pale yellow or cream colour, which enables them to be transmitted more clearly.

The microphones used for the sound portion of the transmission are somewhat similar to those employed for sound broadcasting, and are carried on a telescopic boom, very much as for talkie recordings. The output from the microphones is also fed to the producer's control room, and from thence proceeds to the sound transmitter.

Rather different methods are used for the scanning of cinematograph films, which often form items of the television programmes. For this purpose, the film is moved forward continuously in a projector instead of in a series of jerks, as is done in a picture house. As each picture passes through the projector it is scanned by passing a rapidly-moving beam of light over it and transmitting the light that passes through to a photo-electric cell, which then generates currents of strength depending on the intensity of the light reaching it. The sound portion of the transmission is obtained by passing a beam of light through the sound track and on to a photo-electric cell, in just the same way as is done for ordinary sound-film projection.

In addition to the scenes transmitted from the studios and the films, outside broadcasts of television can now be carried out in much the same manner as the "O.B." sound programmes. Three motor vehicles have been equipped to form a mobile television unit that can proceed to any desired position and televise the scenes required by way of the transmitting station. The unit is linked with the Alexandra Palace transmitter by special cables or, in the case of events outside the area served by these cables, by a wireless link. For the latter purpose, an ultra-short wave transmitter is located in one of the motor vehicles. This is the second vehicle of the unit, the first being used as a control-room, whilst the third carries a petrol-driven power plant which can be used to supply current in places where no other source of electrical energy is obtainable.

Our thanks are due to the British Broadcasting Corporation and the Marconiphone Co. Ltd. for technical assistance in the preparation of this article.

America's Largest Air Liner

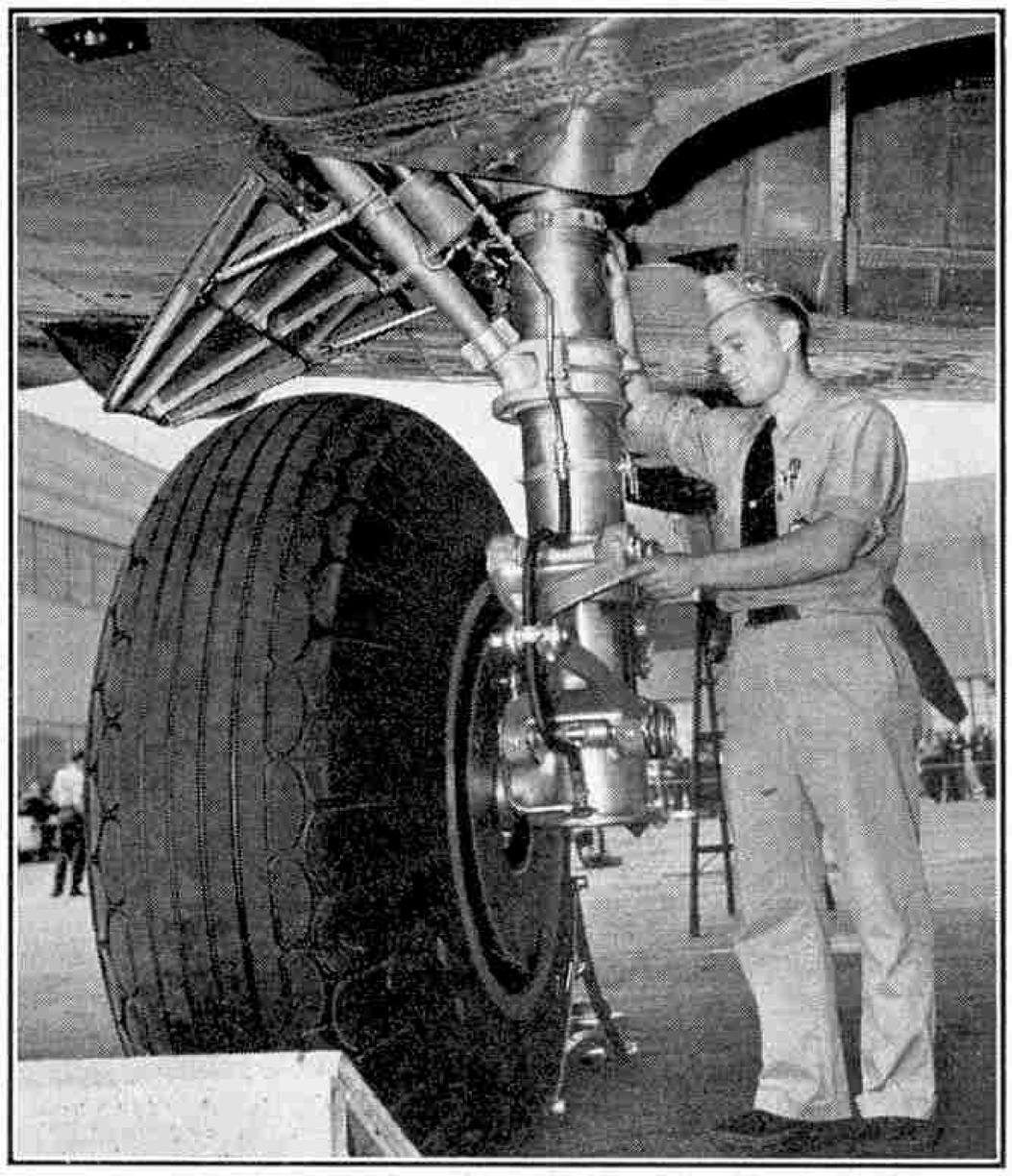
The Douglas DC-4

NEARLY three years ago a group of earnest young men at the Douglas aircraft factory in Santa Monica, California, were busy for several weeks with slide rules and technical calculations, and confidently announced that the aeroplane of the future would do "this, that, and the other." As casually as if they were reciting the multiplication table, these experts, working under the Chief Engineer of the Douglas company, set down performance figures for a proposed four-engined air liner to be called the DC-4, which would be larger than any transport aeroplane in America. They methodically calculated and outlined everything it would do, long before the first rivet was driven into its shiny skin. This giant air liner was completed last Spring, and after four months of severe test flights, it was announced in September that the preliminary performance figures of the DC-4 had more than justified the claims of the technical staff.

The illustration on our cover, which is from a photograph taken by Cy La Tour and Son, California, gives some idea of the great size of the Douglas DC-4, which is designed to carry 42 passengers by day and 30 by night, and a crew of five. It has a wing span of 138 ft. 3 in., a length of 97 ft. 7 in., and it towers 24 ft. 6½ in. above the ground when resting on its landing wheels.

The DC-4 was built to the joint order of the five largest air transport firms in the United States. More than 500,000 hours were spent in developing it from the drawing board to the finished product, a time that represents not so much the difficulties and problems of building an aeroplane of such great size as the careful research and testing of parts and new features that had to be carried out. A model with a wing span of 8 ft. 3 in. was built, and with this 866 wind tunnel tests were carried out by the Douglas engineers at the Guggenheim Aeronautical Laboratory of the California Institute of Technology. In addition a testing laboratory in charge of outstanding engineers in their profession was kept busy for more than two years developing information on materials and design, and most of the important parts of the DC-4 were built and then deliberately and scientifically destroyed in this laboratory in order to test the calculations of the engineers and designers. Special machinery and fittings were designed and built at the Douglas factory, often at great cost, to carry out this work, and in all 265 major structural tests were performed.

The new air liner closely resembles previous Douglas transport aircraft in its general proportions and construction. The leading edges of the huge wings are swept back sharply towards the tips, and the straight trailing edges are fitted with long ailerons and slotted flaps. A split flap is fitted to that part of the wing centre section that is under the fuselage. This fuselage is of typical Douglas style, with a double row of windows along each side like the "Sleeper Transport" described in the October 1938 *"M.M."* The roomy and enclosed cabin for the two pilots is high up in the forward part of the fuselage and well in front of the engines and wings, so that the occupants have a clear view on three sides. The radio compartment is immediately behind the pilot's cabin.



The Douglas DC-4 has a "tricycle" undercarriage. This photograph shows one of the two main wheels, with a Douglas employee beside it to illustrate its great size. Photograph by Cy La Tour and Son, California.

The tail unit of the DC-4 is very much bigger than that of the earlier Douglas air liners, and has three fins and rudders. The undercarriage also is different, and is of the three-wheel or "tricycle" type. This type is particularly suitable for commercial aircraft of such great size, for with it the aeroplane is able to maintain a horizontal position when taking off or landing, which of course means increased comfort for the passengers. The DC-4 in fact can literally be "flown into the ground," a great advantage when blind landings are being made.

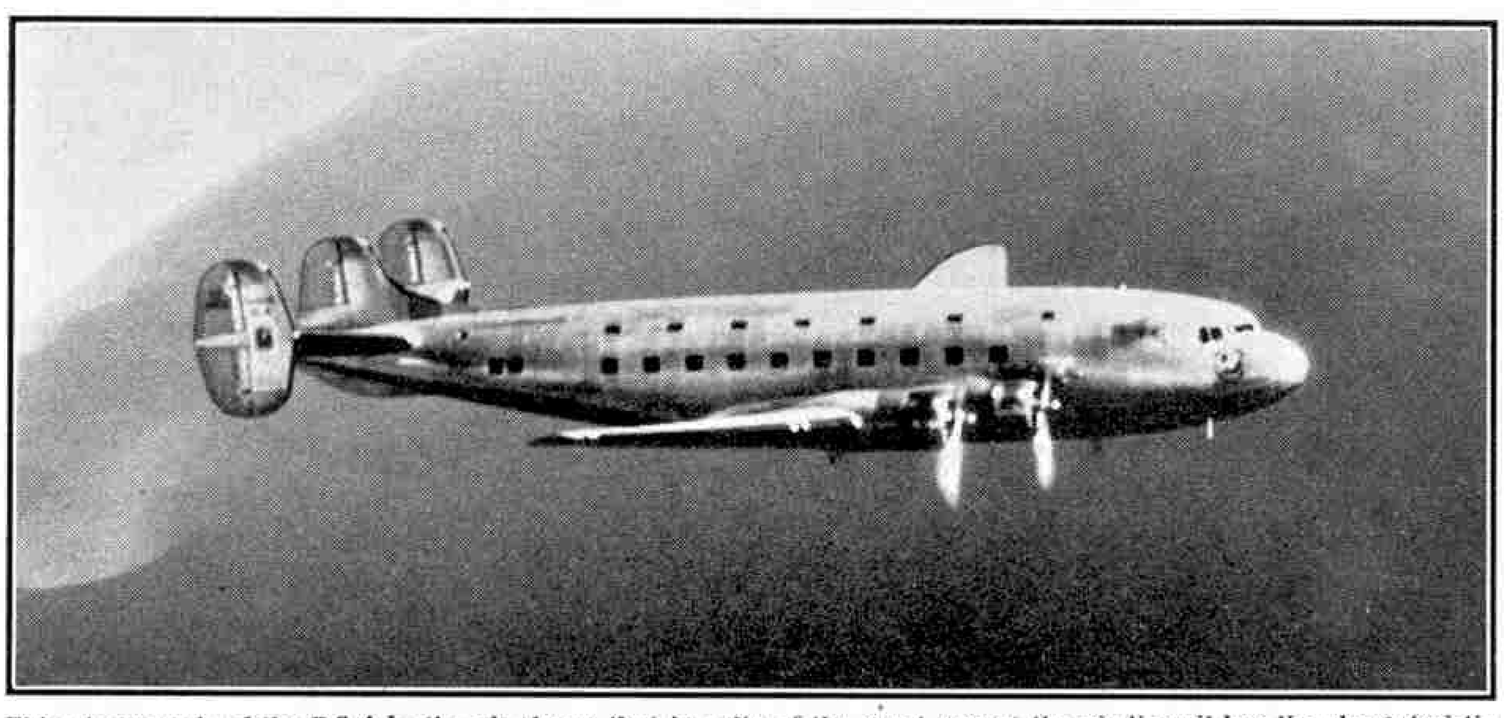
When the assembling of the DC-4 was completed, there remained the big task of putting the aeroplane through its paces. This exhaustive testing was done in two stages. The first was the most troublesome, as it consisted in effect of flying and landing the aeroplane without taking it out of the hangar. This was done by applying on the ground forces of the same magnitude as those that were expected to act upon the aeroplane actually in flight, and the tests continued for as long as the time required by the machine to fly round the world nearly three times. Lead bars with a total weight of 1,000,000 lb. were distributed in the fuselage and over the wings to represent load conditions, and all the strains met with in taxying, flying and landing were reproduced with the aid of these bars, and of hydraulic jacks, chains, blocks-and-tackles, and special riggings.

A fine view of the DC-4 on the ground. It is the largest aircraft of its type ever built in America, and has a wing span of 138 ft. 3 in.
The illustrations on this page are by courtesy of Douglas Aircraft Company, Inc.

Normally prototypes of new aircraft are tested by piling loads on the wings and fuselage after the aeroplane has been inverted. The DC-4 was much too large to be handled so unceremoniously, and therefore special methods and structures had to be designed to test it. The engineers and their assistants worked as a team, each man being given definite tasks to perform during the actual applications of loads to the aeroplane, and several rehearsals were held to make certain that each man knew exactly what he had to do and when he had to do it. There were 201 separate points on the aeroplane at which deflection readings were taken from sensitive instruments as each successive load was applied, and in some of these tests the aeroplane was loaded to $3\frac{1}{3}$ times its gross weight.

The most complicated and spectacular tests concerned the deflection of the outer-wing panels of the aeroplane during flight, and to reproduce this condition the engineers erected huge steel structures rather like small skyscrapers, each 40 ft. long and 30 ft. high. Cables passing over pulleys on these structures were hooked to the leading edge and upper skin of the wings, and they were tugged upward by blocks and tackles to simulate up-load, or "suction" lift, during flight. At given signals 12 men at the end of blocks-and-tackles gradually increased this load, and at the same time under the inner-wing sections hydraulic jacks, operated from a central control board, pushed upward with tremendous force. During some of the tests a total of 180,000 lb. of upward load was applied to the wing. In the down-load conditions a combination of deadweight of pig lead and hydraulic jacks pulling against the engine nacelles exerted another 180,000 lb.

One of the most interesting tests carried out was the reproduction in the hangar of all the forces that would be exerted in "zooming" the huge aeroplane upward while travelling in the air at 240 m.p.h. and climbing at the rate of 2,000 ft. per minute. The "tricycle" undercarriage was also very severely tested, and 50 "drop" tests, each equivalent to a landing, were carried out.



This photograph of the DC-4 in the air shows that in spite of the great size of the air liner it has the characteristic and graceful lines of earlier Douglas transport aircraft.

When the last test was finished and the final figures had been checked and re-checked, the DC-4 was pronounced ready and fit for its acceptance flights, the second phase of its trials. It was hauled out on to Clover Field, the aerodrome that adjoins the Douglas factory, for these tests, and a huge crowd of spectators and enthusiastic employees watched the great aeroplane make its maiden flight. A photograph of it about to take-off on this occasion was reproduced on page 496 of the September 1938 "*M.M.*" The aeroplane was piloted by Major Carl A. Cover, a Senior President of the company and a very experienced pilot, and had a small crew on board.

The long series of test flights were carried out over a period of four months, and the DC-4 was in the air about 72 times. The trials included climbs, stalls, banks, loads and control tests, altitude and fuel consumption tests, take-offs and landings. A series of flights over a measured speed course included 1 hr. at full power at 10,000 ft. and 1 hr. at 1,000 ft., and the guaranteed high speed of 240 m.p.h. was exceeded by a comfortable margin. With all four engines working and with a full load on board the aeroplane made a series of "sawtooth" climbs, during which it rose above 25,000 ft., and its rate of climb was over 1,000 ft. per min. when 8,000 ft. up.

In all these tests specially designed equipment recorded detailed performance of the engines and various components to a waiting staff of engineers and observers. On every trip a Flight Test Engineer in the cockpit supervised the operations. He was connected by telephone with the observers in the cabin of the aeroplane, listening to the readings of his assistants and repeating them as well as making his own observations. All these were recorded so that they could be transcribed later by gramophone to supply the engineers with full information on the behaviour of the machine in flight.

The prototype DC-4 is fitted with four Pratt and Whitney "Twin Hornet" engines, which develop a total of 5,000 h.p. for the take-off. It can be arranged to have a cruising range of 2,200 miles.

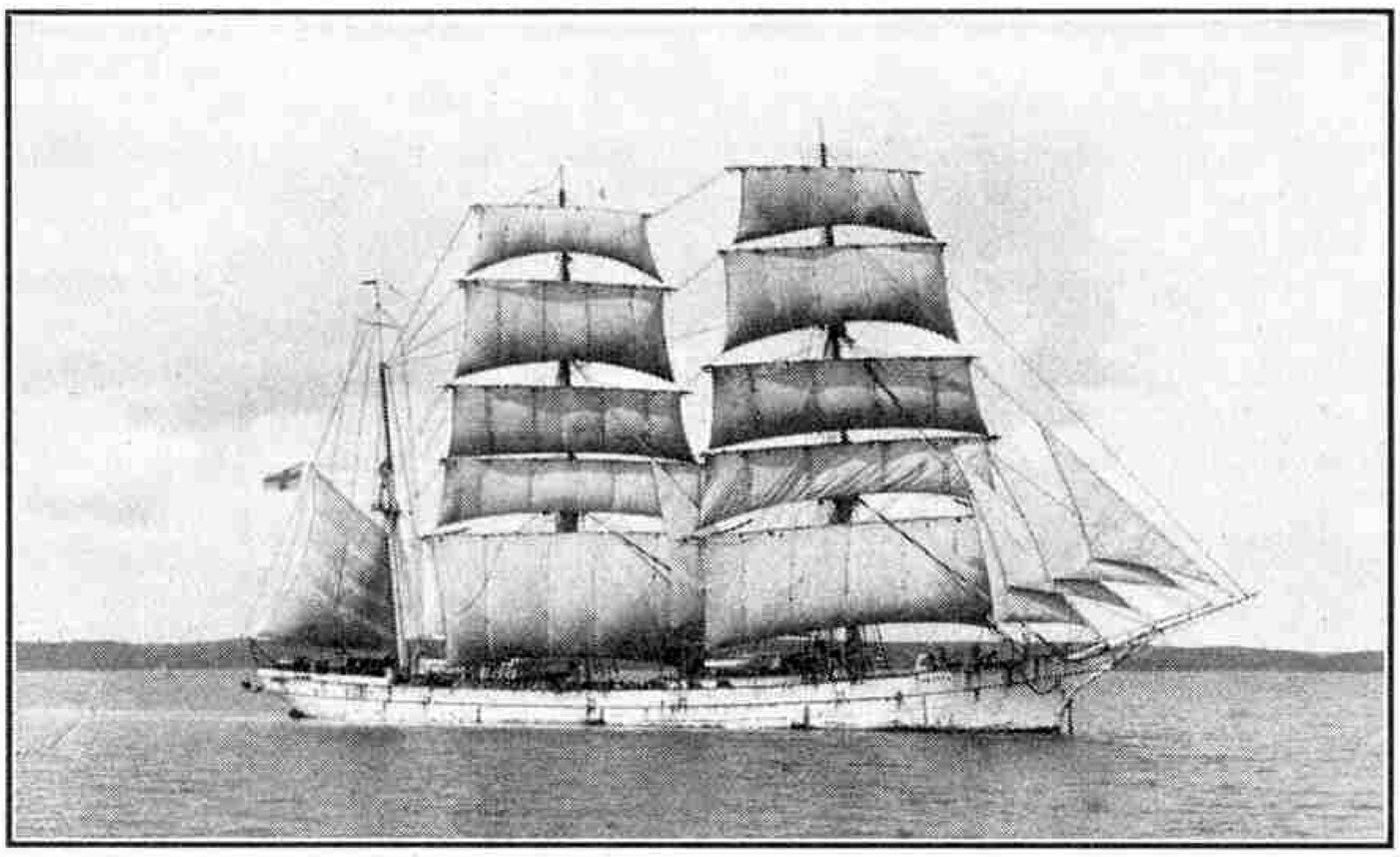
The Vanishing Grain Fleet

Survivors of the Great Days of Sail

By Alec A. Purves

THIRTY years ago, square-rigged ships under full sail were quite a usual sight around our shores. But time and tide, together with the ravages of war, have reduced their numbers from several hundred to about thirty.

Although to-day none of the sea-going vessels wears the Red Ensign, many of them were built in British shipyards, and we can still maintain a national pride in their existence and performance. The majority of these survivors are under the Finnish flag, and belong to Capt. Gustav Erikson, with Mariehamn as their home port. Most of the others are owned by the remaining Scandinavian countries and by Germany, all of whom require their officers to be trained in sail.



The three-masted barque "Favell," launched in 1895. This was the last of the Bristol-built sailing ships. She was broken up in 1934.

A dozen or more of these windjammers are regularly engaged in the grain trade between Australia and this country. Towards the end of each year they leave Finland, or wherever they happen to be, for Australia, where they load grain at various ports. In the spring they begin their race to England. Although these races are not like the China clipper races of last century, when the first ship home received the highest rate for her new-season's tea, they nevertheless attract considerable interest, and competition is keen to establish records, as far as is possible with their minimum crews. It must be remembered that nowadays they are manned by only a score of boys, as compared with more than double that number of men in the old days.

The average time taken from Australia to Falmouth, where they receive orders regarding port of discharge, is about 100 days. Less than 90 days is considered a very fast passage, but a few ships exceed 120 days. The following passage times for some of the 1937 grain fleet are given as an example:

Pommern	94 days.	*Olivebank*	106 days.
L'Avenir	95 ,,	*Lawhill*	107 ,,
Passat	96 ,,	*Abraham Rydberg*	112 ,,
Archibald Russell	97 ,,	*Killoran*	116 ,,
Pamir	98 ,,	*Winterhude*	126 ,,
Viking	103 ,,	*Penang*	138 ,,

These ships all come to British ports in the summer and autumn, and are much visited and photographed by shiplovers. They can be seen in the Millwall Dock, London; Prince's Dock, Glasgow; and at Liverpool, Leith, Ipswich, Barry, Blyth, Queenstown and elsewhere.

Before looking at some of the individual ships, let us take a brief glance at their ancestry.

Sailing ships had borne the world's sea trade for centuries before the coming of steamships just over a hundred years ago. At first the newcomers were not popular, but after 1850 they became serious rivals, and the very fast clipper ships were built to compete with the improved steamers.

The opening of the Suez Canal in 1869 was the first of many heavy blows struck at sailing ships. They could not use the new short route to the east, because the winds were not favourable; so they concentrated on those cargoes for which speed was not so important. Many of the clippers transferred to the Australian wool and grain trades. In many cases, however, they were not large ships, and with carrying capacity the chief requirement, the large grain-carriers began to appear. These are the ships we see to-day, but only a mere fraction of the original number. Few square-riggers were built after 1905, although one or two have been launched as training ships in recent years.

The survivors of the British-built vessels include the four-masted barques *"Abraham Rydberg," "Archibald Russell," "Lawhill," "Olivebank," and "Pommern,"* and the three-masted barques *"Killoran"* and *"Alastor."*

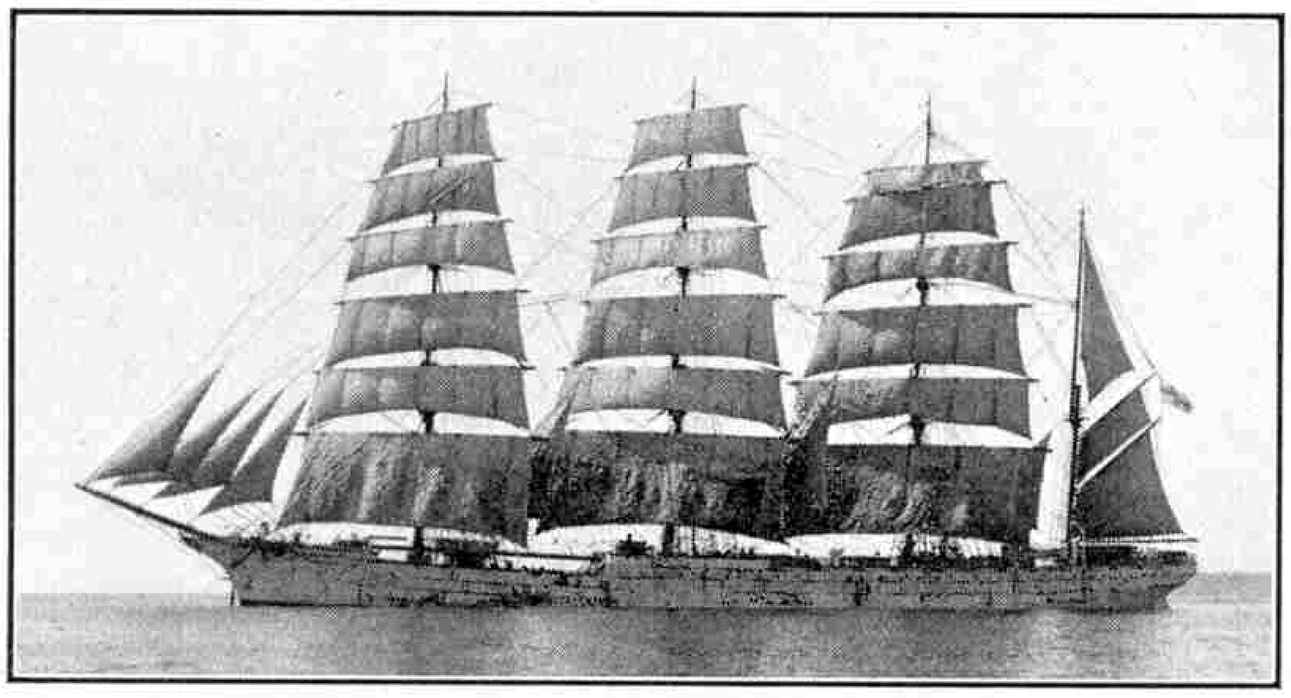
Perhaps the finest of these is the *"Archibald Russell,"* built at Greenock in 1905. In her early days she had the traditional broad white stripe along her hull, with black painted "gun ports," typical of the old clippers and windjammers. An unusual feature is the flying bridge running the full length of the ship, from fo'c'sle to poop.

The smaller *"Killoran,"* built in 1900, was also once "port-painted." She is a trim little vessel, but it is rumoured that she will shortly be broken up. The photograph shows her unloading at Ipswich.

Most of the windjammers have had a varied career. The *"Abraham Rydberg,"* for instance, was built on the Clyde in 1892 as the *"Hawaiian Isles,"* 2,345 tons. Later she became the *"Star of Greenland,"* one of the famous "Stars" of the Alaska Packers fleet, and traded to and from Alaska with tinned salmon. She is now a Swedish-

owned training ship, and was in Millwall Dock a few months ago with her cargo of grain.

The "*Olivebank*," also built in 1892, was scuttled by her crew in 1911 after a fire had occurred on board, but she was salvaged and refitted. On a previous occasion her fore, main and mizzen masts and rigging were carried away in a storm, but she managed to limp back to port. She was transferred to the Norwegian flag in 1913, and when Swedish owners bought her in 1923 her name was changed to "*Caledonia*." Capt. Erikson bought her in 1924, and followed his usual practice of restoring her original name.

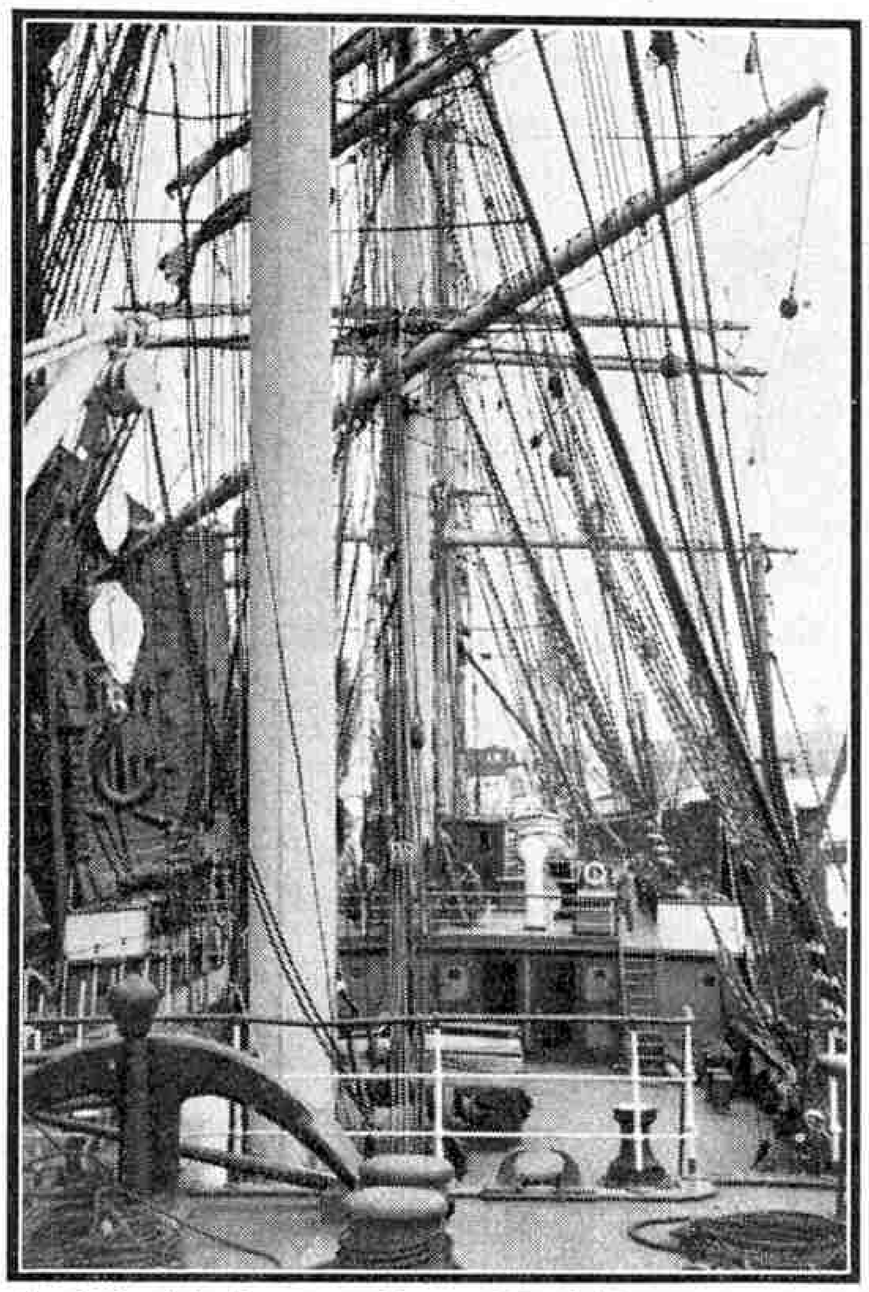


The "Herzogin Cecilie," which was wrecked off Salcombe in April 1936. She was probably the finest sailing ship surviving to recent times.

One of the oldest windjammers afloat is the "*Alastor*," built at Sunderland in 1875. She served in the Shaw, Savill and Albion Line to New Zealand, and was sold to Norway in 1895. She is now in the timber trade, under the Finnish flag, and visited Regents Canal Dock last year.

The German-built "*Padua*" recently had an unusual voyage. She was chartered by a film company for the making of "*The Mutiny of the 'Elsinore'*," the film story of Jack London's sea yarn. She went out to Funchal with a motley crew of apparent cut-throats, and surprised several shiplovers who read the words "*Elsinore*"—Glasgow" on her stern. The mystery was solved, however, when they saw "*Padua*" on her bows.

Two of the most beautiful of all the windjammers are shown in the accompanying photographs. Although neither of them is afloat to-day, they both survived until quite recently. The three-masted barque "*Favell*," 1,363 tons, launched in 1895, was the last of the Bristol-built windjammers. Although no clipper, her fine lines and beautiful figurehead endeared her to sailors and shiplovers alike. In 1926 she made a record run of 80 days from Copenhagen to Melbourne, but took 157 days on the return passage to Falmouth, a striking example of the vicissitudes of sailing ships. Nearly the whole of her life was spent under the Finnish flag, and she was broken up in 1934.



The deck of the four-masted barque "Pamir" in the East Float, Birkenhead. This vessel is one of the fleet of sailing ships owned by Captain Erikson, Mariehamn, and in 1932 was the leader in the unofficial Australian grain ship race. Photograph reproduced by courtesy of A. F. Burr, London.

The "*Herzogin Cecilie*," the pride of the Erikson fleet and probably the finest ship surviving to recent times, was wrecked off Bolt Head, South Devon, in April 1936. This four-masted barque of 3,111 tons was built in 1902 by the famous firm of Rickmers of Bremerhaven. She was intended as a training ship for apprentices, and, like "*Viking*" and "*L'Avenir*," she had much better accommodation than the purely commercial ships. She measured 337 ft. overall, and carried 56,000 sq. ft. of canvas. She often came to England with her cargo of grain, and was easily recognised by her fine figurehead of the Duchess Cecilie, and by her long poop deck and divided spanker.

"*Schullschiff Deutschland*" and the Polish "*Dar Pomorza*," two recently built training ships, are both ship-rigged. Very few ship-rigged vessels are afloat to-day, the majority of the windjammers being barque-rigged. The difference is that a ship is square-rigged on all masts, whether three, four or five, while a barque is square-rigged on all except the after-most mast. The reason for the survival of the barque rig is on the grounds of economy, more hands being required for a full-rigged ship.

And so the yarn could go on, each ship having some story or peculiarity; "*Winterhude*," with her bald-headed rig, carrying no royals; "*Viking*," with her poop deck running two-thirds the length of the ship, "*Priwall*" of the "Flying P" Line, and so on.

Every year one or two names disappear from the register. Those who love the windjammers shake their heads and wonder for how much longer the white sails will spread, driving the tall ship that was once the proud mistress of the seven seas. One wonders what will happen to the ships owned by Gustav Erikson when this fine old sea-dog passes on. I recall Erikson's own words quoted in "*Sea-dogs of To-day*" by A. J. Villiers, a book that every sea lover should possess and read often:

"I love those ships," he says, "I have spent my life in them and for them, and I will keep on. When I go they go; but while I stay they stay. . . . How can I keep them on? Because I never have a holiday; because I look after them all personally; because I don't let others do anything I can do myself; because I keep always a good lot of young chaps in them who are trained in them to become officers; and because not one of them is insured. I cannot afford to have them insured. . . . . I have been a mate and master, too, as well as cabin-boy and cook. I have the ships brought home to Mariehamn whenever they have to lay up in Europe, and I climb the rigging and go out along the yards myself and do my own surveying. I see that . . . the masts and yards will carry their sail round the Horn and anywhere else I send them."

Behind the Scenes in a Film Studio

How Talking Pictures are Made

By Monica Revell

TIME and time again people have said to me: "Yes, I read all about the 'shooting' of films, but what is it really like?" Well, here is the answer.

The specialists who make films are, rather surprisingly, jacks-of-all-trades too. That is to say, in the studio it is team work all the way through, and you can't weld a team together unless each member understands more than a little of the individual work of the rest of the team.

The captain of this team is the producer. He is the man who already has a working unit or engages one. He must of course have finance at his command too. His unit consists of departments, which include Art, for the designing and building of the staging or "sets"; Property, which arranges furniture, fittings and gadgets, sometimes also inventing the latter; Wardrobe; Make-up and Hairdressing; and of course the Camera departments, which include both motion and still sections. Then there are the Writing department, from which comes the scenario; the Casting department, which arranges the contracts of the actors and actresses, who are more commonly known as "artistes"; and the Publicity department, which makes the productions known.

Work in progress in a film studio. The director is giving instructions to one of the artistes, with the cameramen, electricians and others waiting. On the extreme right is the boom boy, with his hand on the lever controlling the overhead microphone pole, or sound boom.

When the producer has chosen his story he engages a director, and it is the director's job to tell that story, thrilling, romantic or comic, in as convincing a way as he can, using his artistes and all the help that can be given from the unit. With such an army of helpers it sounds as though a director's job is an easy one. Actually leading this army is no light task. To begin with, the director must be a real leader of men. He also has to have an artist's eye so that he can present a well-balanced picture on the cinema screen, and he must be a born story-teller. In addition he will have to work to an agreed schedule, which details time for everything, and expenditure.

Visiting a studio in production, you will first of all see behind the scenes, which looks for all the world like the backs of advertisement hoardings, with the floor a mass of 3 in. or 4 in. electric cables. Picking your way over the cables, you may find a room with three sides and no ceiling, which is all that is necessary for the needs of the script. No more than is actually required is ever built. Among the cables a small box seems to provide a good means of elevation, but when you have mounted on this some good-natured voice will call out: "Get off the spider box, pal," and you will learn that your grandstand is the fuse box and therefore not the safest place to choose.

Facing the artistes in this three-sided room is the camera. It is in charge of the operator, who actually photographs, and the lighting expert, who is his chief. Various other people work on the camera too. These are the young assistant who focusses, and the crew, who are known as the "grips."

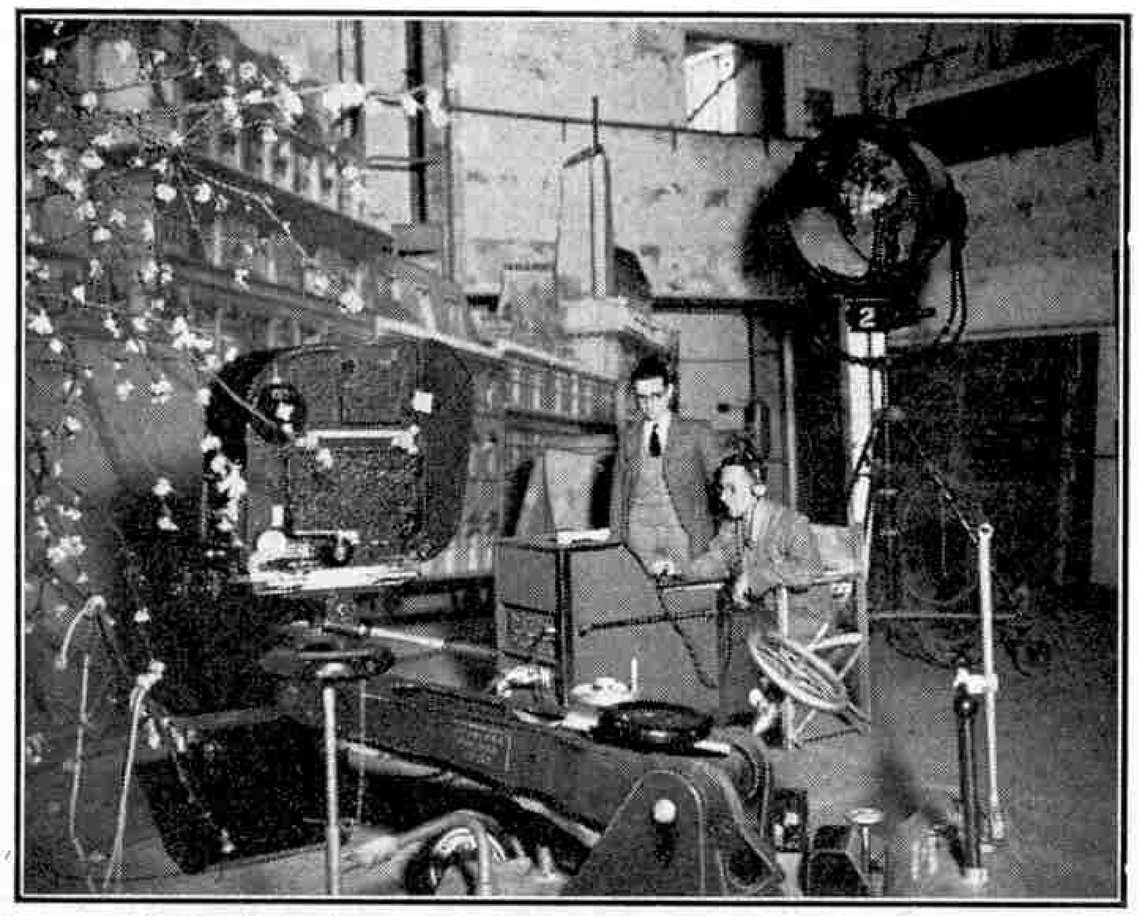
Seated under the camera is the director, and by his side is the script girl or, to give her a more imposing title, the "floor secretary." Sometimes she is even called "continuity girl." The director sets up his scene. He looks through the camera and has it focussed at an angle to cover just so much of the set as he wishes his artistes to work in. He next rehearses his artistes. Timing and movement are so important that he will often "run through the mechanics," by which he means that his artistes make their exits and entrances and go about the business of the scene within camera range, before he proceeds to dialogue. All technical departments are incessantly on the watch to check, correct and improve their work.

The script girl at his elbow has a busy time. She times the length of each "take" with a stop-watch, and checks up that the dialogue is accurate. She is alive to everything; she notices the positions of the properties and what the artistes are wearing, and makes notes of each shot and all relevant matters for future use. At the end of each day it is her job to send in a detailed report, which is invaluable in the cutting of the film, or for any "matching up" at a later date.

The director bears in mind constantly that the camera lens is the eye through which all audiences will see his picture, and that the audience must know the point of view of all the characters in the film as the story unfolds. To do this he must have the camera moved about, first to show the viewpoint of this artiste and then of that. Now suppose his film is a mystery story, and the butler at a dinner party comes into possession of a most important clue. That dinner party scene has to be established. Possibly as the butler enters the room he is startled by

something, and as members of the audience must see everything as if they were looking over his shoulder, the camera moves up to where he is standing and records all he has seen. There is first a "long shot" showing the long banqueting hall; the camera possibly "pans," or moves round as though one's eyes have swept the room, and comes to rest on the important action which caught the butler's attention. In fact, whatever the butler has seen, the camera lens must see it too for the benefit of the audience.

The butler walks into the room; the camera must be put on the "dolly track" and moved in at the same rate. The butler stops; the camera must do the same. The butler overhears important conversation; the camera must be in such a position that it is within earshot, for it would strike the audience as ridiculous if the butler could hear a whisper from an unreasonably long distance. Through all this action the director, being a jack-of-all-trades, will know the camera's limitations and will not ask the impossible of the cameraman.



The sound recording engineer at work on the set. His instrument regulates the sound and relays it to the sound room, where it is actually recorded.

In addition to the "movie" cameraman another photographer is always in attendance. He is the "still" cameraman, so-called because he takes still pictures as opposed to the action picture shot on the reels of film. Four main classes of still pictures are taken. These are portraits, production, set and news. Portraits are taken of all principal artistes and are used for advertising and publicity generally. Production still gives the keynote of each scene of the story. For these the artistes are posed on the set after the movie camera has finished each scene. They are usually taken by means of a stand or field camera, and one of the uses of these prints, which measure 10 in. by 8 in., is for show purposes outside cinemas. Set stills are the photographs taken of the "sets" for record purposes; no artistes appear in these. News stills are for use by the publicity department.

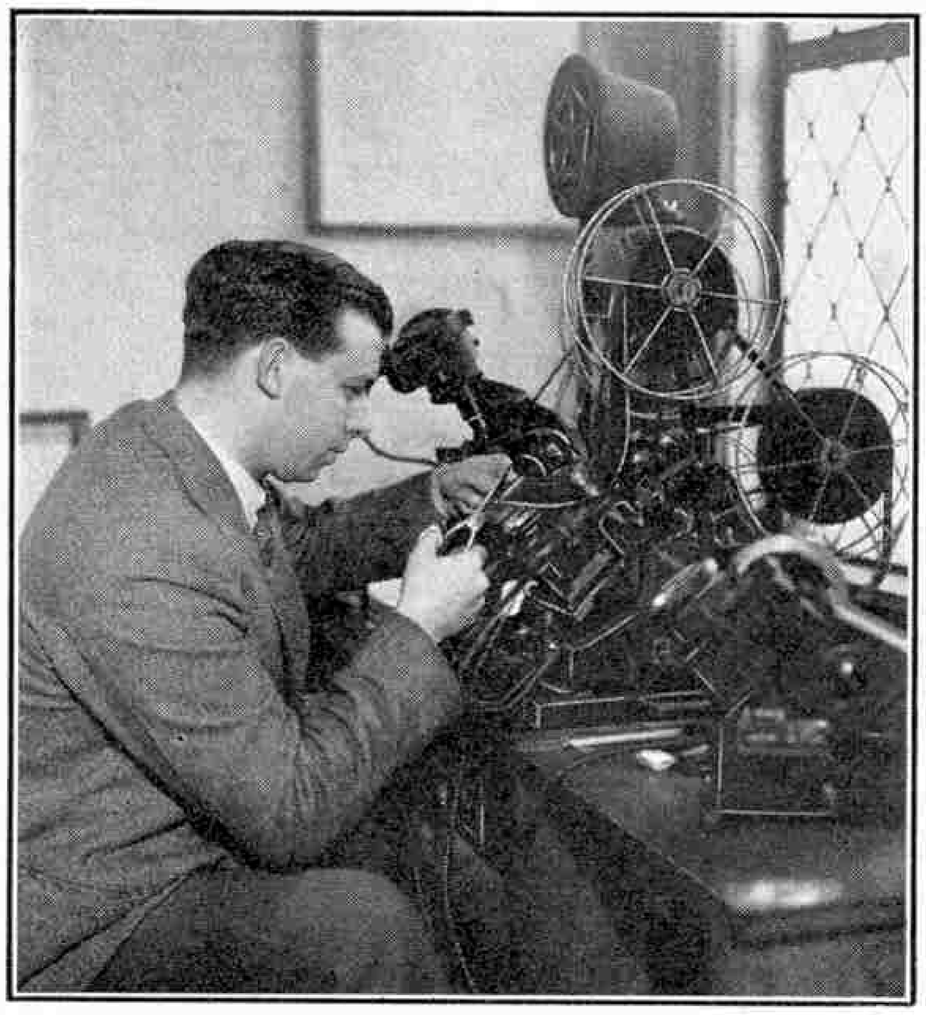
The sound man, whose title is recording engineer, has been busy. His young assistant, the "boom boy," operates the boom arm, from which is suspended the sensitive microphone. This must be kept always at the same distance from the speaker, and must be turned ready to face each artiste in turn as he or she speaks. Leads connect the boom to the mixing panel at which the recordist sits, and from his panel more cables connect with the sound room. The record of the sound is made by photography on a separate film.

Shooting exteriors away from the studio is known as "location." There work goes on in the same manner as in the studio, even to using lights and reflectors to light up the scene and to eliminate shadows, and the director has the camera moved about just as much.

An aerodrome sequence in the film "*Mr. Satan*" will illustrate this point very well. The camera had to photograph the viewpoint of Franklyn Dyall taking off in an aeroplane and looking back at Skeets Gallagher, the American comedian. This shot had to take place not many feet from the ground, and the handiest platform was the top of the aeroplane itself, which the camera crew used. A few minutes later the camera was brought to the ground to "shoot" Franklyn Dyall as he would be seen by Skeets.

No "take" is ever passed until every technical department is satisfied that it is good. Therefore, as a great saving in time and expense, musical numbers for songs and dances are recorded first, and a "mute" shot, which is picture photography only, is made afterwards. For the musical recording costume and make-up are not necessary.

At the same time that music is recorded on the sound track it is also recorded separately for play-back purposes. It is the play-back recording that is used to enable the artistes to synchronise action to sound. One of the systems used records on a disc and its operation is rather like playing a gramophone.



The film editor, or cutter, holding the sound and picture films while synchronising them.

When the picture is completely "shot" it merely means that the camera has done its work. Now comes the task of "dubbing" in sound and editing. Dubbing means that incidental music and other sound effects are added afterwards, each being recorded on a separate track and all eventually re-recorded together. To illustrate this by means of an extreme example, let us suppose that a scene is set in the restaurant car of an express train and the diners are listening to the radio when a cat mews. Separate records are made of all sounds, conversation, the roar of train, the whistle as the train enters a tunnel, the radio background and the mew of the cat. These sound tracks are run through together as desired, and re-recorded on one film track.

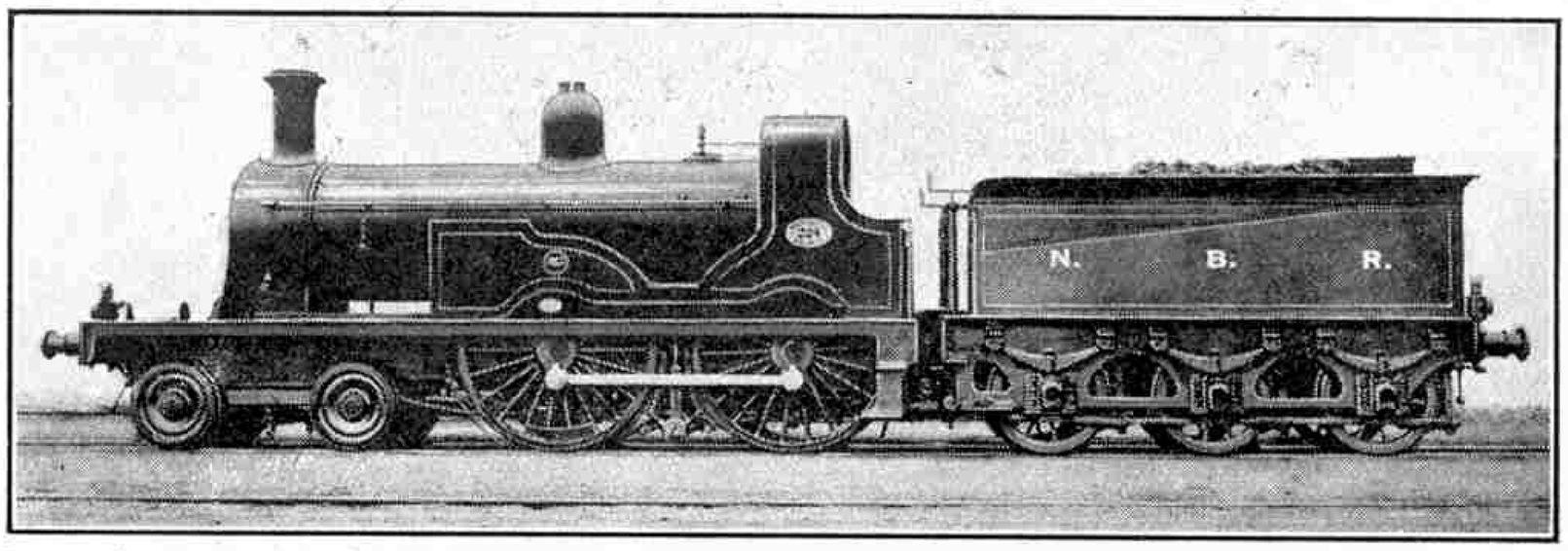
The developed sound and picture films are taken to the film editor, whose job it is to piece them together. He is commonly called the "cutter." He has an instrument called a movieola to aid him. This reproduces sound and picture in miniature as he works, and he can wear earphones or use the loudspeaker as he cuts and welds together, and matches sound to action.

Historic Locomotives

1. The "Tay Bridge Engine"

By C. Hamilton Ellis

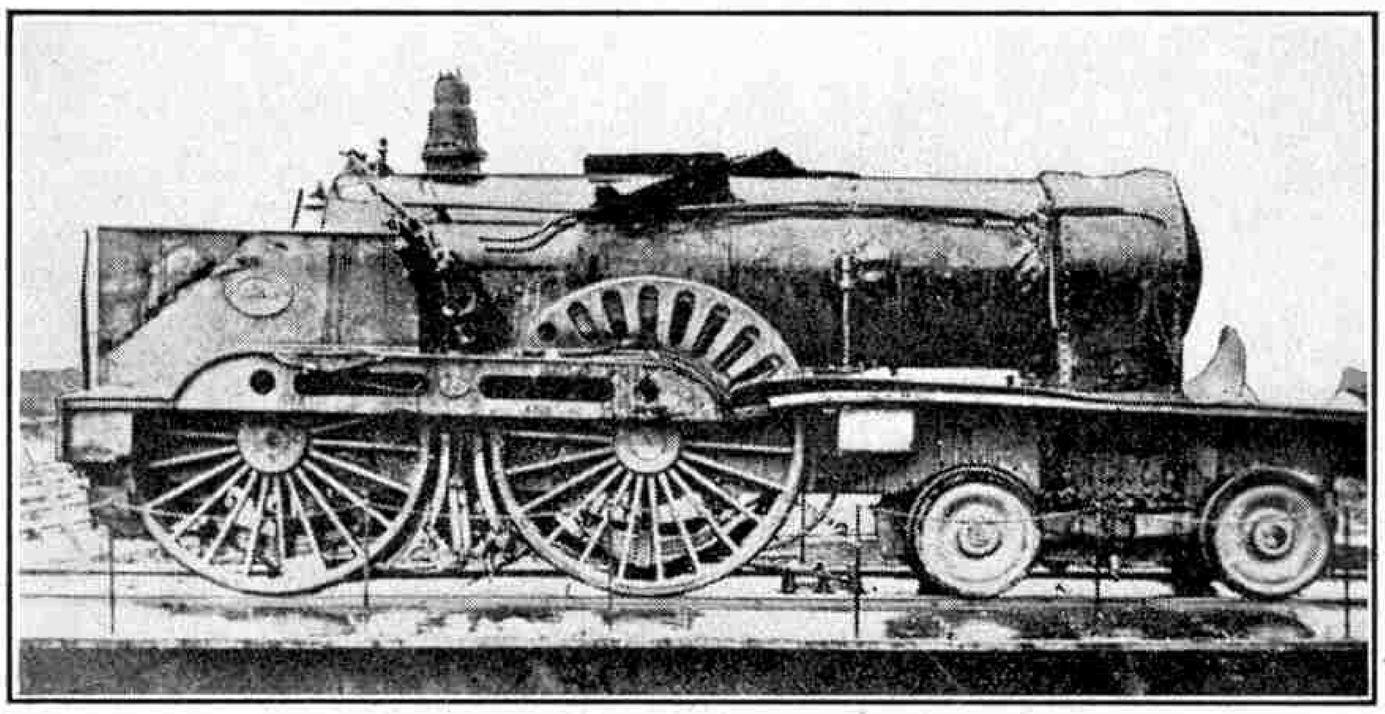
A FEW days before the date of publication of this issue of the *"M.M."* there occurred the anniversary of one of the most terrible yet mysterious accidents that has ever befallen a railway train—terrible because a complete train load of passengers and the train crew lost their lives, mysterious because it has never been fully explained. This accident was the Tay Bridge disaster of 28th December, 1879, and the principal claim to fame of the subject of this article, North British Railway locomotive No. 224, was a sombre one, for as a result of this calamity she spent several months in the mud at the bottom of the Firth of Tay.



Locomotive No. 224 of the former North British Railway in 1897. This engine was involved in the Tay Bridge disaster of 1879, but was recovered and remained in service until 1919. Photograph by courtesy of the L.N.E.R.

No. 224 was a notable engine in other ways as well, however, Even to-day, the 4–4–0 locomotive with inside cylinders is common enough to be a typically British variety. In earlier years it might have been described as the standard British express engine, and N.B.R. No. 224 was the first British standard gauge inside cylinder express locomotive of this wheel arrangement. She was designed by Thomas Wheatley, and built, together with a twin sister, No. 264, in 1871. In her original condition she had a plain "stovepipe" chimney and a very small cab, while the dome was over the firebox instead of in the more usual position, on the middle of the boiler barrel. The coupled wheels were 6 ft. 6 in. in diameter and the cylinders 17 in. by 24 in. Both the engine and the six-wheeled tender had a rather short wheelbase.

At the end of the "seventies," No. 224 was usually to be found in the Dundee district, being at the time the spare engine at Dundee shed. On Sunday, 28th December 1879 *"Ladybank,"* the engine usually employed to work the evening mail train from Burntisland, broke down, and No. 224 was consequently called upon to fill the gap. So it was quite by chance that she came to figure in one of the greatest tragedies in the history of railways.



No. 224 in April 1880, after being recovered from the Tay. The engine was little damaged considering the character of the mishap, of which there was not a single survivor.

That afternoon a storm such as few could remember had broken over the country. Those who were out on the streets fought desperately to make any headway at all against the terrific gusts of wind. Tiles, chimney-pots, branches of trees, and even whole roofs went quoiting in every direction. When the northbound mail train stopped at St. Fort, the last station before Dundee, several passengers jokingly asked the guard whether the train would be able to push its way across the Tay Bridge in the teeth of such a gale.

At 7.13 p.m. No. 224 and her seven carriages, with 73 people aboard, passed the signal cabin at the southern end of the Tay Bridge. Signalman Barclay passed the train staff to Driver Mitchell, for the old Tay Bridge had only a single track, and the train puffed slowly but steadily along the great bridge. Barclay and Foreman Watt, who was with him, watched its lights until they reached the high girders forming the middle section of the structure. Then, in the midst of a tremendous gust of wind, they saw a shower of sparks and a flash of falling fire, far out over the water. Nothing more was seen but it became apparent later that a huge section of the bridge, with the train and everyone aboard imprisoned within the girders, lay deep down in the muddy depths of the Tay.

With the errors in design and construction which led to the collapse of the bridge this story is not concerned. Divers discovered the whole of the train on the following Wednesday. The engine lay on her side, in full forward gear, which showed how sudden had been the calamity.

During the following spring the brig *"Henry"* was fitted out as a salvage vessel for recovering the wreckage. Early in April, the tender of No. 224 was recovered, and shortly after the engine followed. and was set on the rails at Tayport. She was surprisingly little damaged, as the lower illustration on this page shows, and was soon in service again. But when the new Tay Bridge had replaced its ill-fated predecessor No. 224 was not allowed to cross the Tay, for sentimental reasons.

Some years later the engine was rebuilt as a tandem compound, the high-pressure cylinders being placed directly in front of the low-pressure, all four cylinders being inside the frames. She ran in this form for some time, but the experiment was not carried further. No. 224 was altered back to her original state, and in 1897 she was again rebuilt, by Matthew Holmes, with a more modern type of boiler. From the upper illustration on this page it will be seen that she was then made to conform to the external standards then observed on the N.B.R. that had been instituted largely during the reign of the redoubtable Dugald Drummond at Cowlairs. Thus on the new boiler the safety valves were mounted on the dome. The sheet wings characteristic of many Scottish locomotives appeared at the base of the smokebox front, and a more shapely chimney replaced the original stove pipe. The solid bogie wheels were retained. Apparently the ban against crossing the Tay was removed at this time, but the usual run of the engine was between Edinburgh and Perth, and at a later date between Hawick and Newcastle, over the Border Counties line. This route was for years a favourite last resort for old North British engines and at one time was the haunt of some really antique locomotives.

In 1913, No. 224 was renumbered 1192, her old number being taken by a new 0–6–2 tank engine, now L.N.E.R. 9224. The old engine continued in service until forty years had elapsed since she fell with the first Tay Bridge and in 1919, with nearly half a century to her credit, she was broken up as scrap.

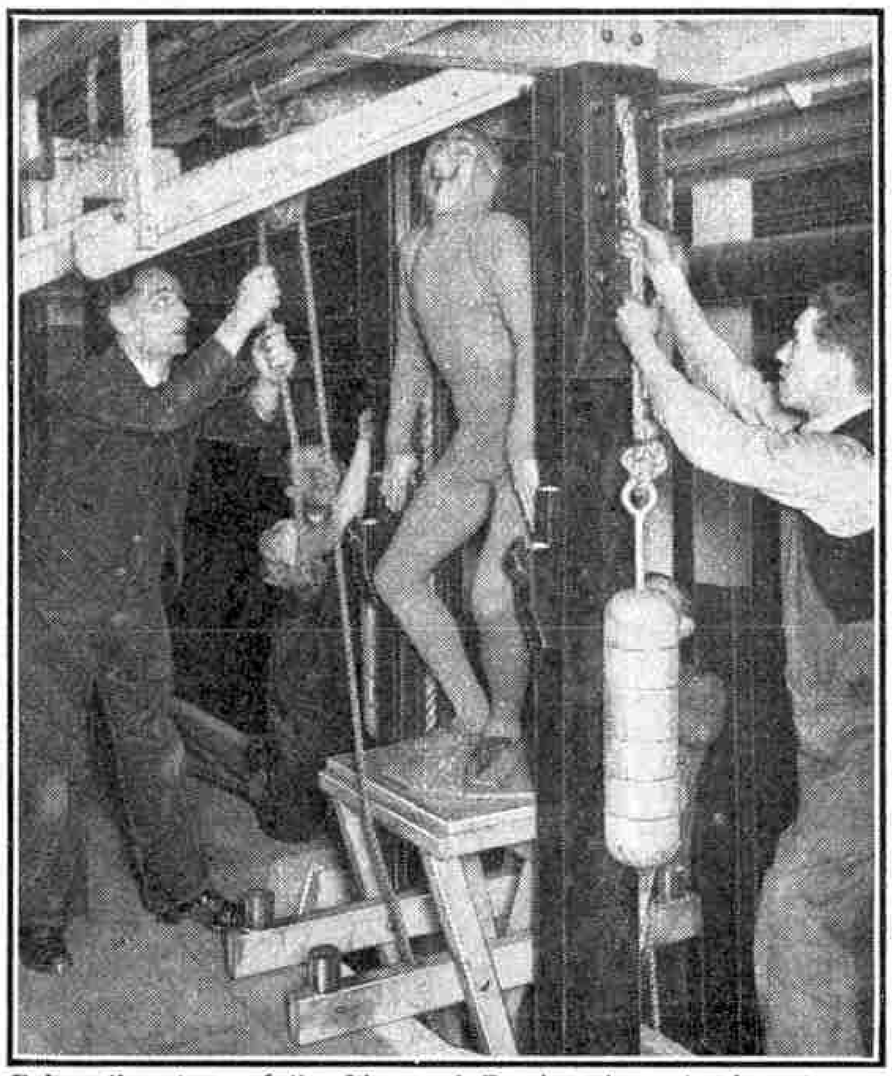
Up through the Star Trap

Secret of a familiar Pantomime Effect

IT is great fun to see the Demon King of a pantomime shoot upward, apparently through the boards of the stage itself, to the accompaniment of an unearthly shriek, or a burst of demoniac laughter. The effect is so startling that some of the younger members of the audience may feel a trifle uneasy; the rest of us know that he has really been catapulted through a trapdoor that opens upward and closes after him, so that after his prodigious leap he drops back on to apparently solid ground.

The stage of practically every modern theatre is far from being the continuous wooden platform that it appears from the opposite side of the footlights. In reality it is a veritable jig-saw puzzle, with movable sections giving access to or from the lower regions, in which are the mechanisms for raising and lowering them. The device used by the Demon King is known as the star trap, from the shape of the sections that rise and fall. It is circular and is cut along lines passing through its centre, so that it is divided into a series of triangular sections, with their points meeting at its centre. On the broad end of each triangle is fastened a piece of leather that also is fixed to the stage and thus acts as a hinge. When the trap is in use the head of the performer pushes the triangular sections up, and the insides of these therefore are covered with linen in order to prevent splinters, and their pointed ends are rounded off and padded.

To go below the stage and watch an artiste being projected from the nether regions into full view of the audience is an interesting experience. Under the trap itself is a small wooden platform, about 30 in. square, which rises or falls, like a lift, between four uprights. Ropes from it pass over pulleys and at their other ends carry heavy weights. When the trap is to be used the platform is held down and the performer steps on it. Its height is then adjusted by half a dozen men, who lift it until the performer's head is just touching the centre of the star. Then they wait for the signal. This is given by the performer, and when he says *"Go"* the platform is flung swiftly upward by the men holding it, while others pull down the ropes with equal gusto, the weights helping it to rise quickly. Constant practice and use develops considerable skill in carrying through this rather startling performance, and the performer is shot through the trap with speed enough to make him rise some feet above stage level.



Below the stage of the Liverpool Empire. A pantomime demon ready to be shot up through the star trap. The photographs on this page are by T. C. L. Hutchinson, Liverpool.

Artiste and stage hands work together with astonishing speed and rhythm in this catapulting performance. It is said that during the presentation of *"Aladdin"* at the Dominion Theatre in London in 1930, Lupino Lane was shot through 72 traps in three minutes. It takes a trained and skilled artiste to perform such a feat. Trap shooting has been a speciality of the Lupino family for generations, and it does not seem as if there will be any break in the succession as yet, for Lupino Lane's son, who is seen in the lower photograph on this page watching his father being shot upward through a star trap, takes part in the training that is necessary for the stage artiste who specialises in sudden appearances and disappearances.

Constant exercise is required to give the agility this performance demands, and every morning during a recent visit of Lupino Lane to the Liverpool Empire, where this photograph was taken, I watched the two, father and son, going through their daily round of tumbling, somersaulting, boxing, swimming and fencing. Little wonder that this well-known artiste is always fit. He knows many ways both on and off the stage besides the star trap. Sometimes he disappears through flaps and doors in the walls of the scenery, often being turned over in the process, either starting on his head and arriving on his feet, or being precipitated head foremost out of view of the audience. In some of his best known acts he has scarcely disappeared when he turns up again at some different point on the stage, with even more startling effect. How he can move about so quickly is a perpetual wonder to those who are not "in the know." Actually he makes the greatest use of springboards, chutes and other mechanical gadgets, but these would be of little use if it were not for his amazing fitness and natural agility.

Star trap opening to allow Lupino Lane to pass through.

Progress of "Central London" Extension

The extension of the "Central London" tube, referred to in *"Railway News"* in November 1937, is rapidly taking shape. This is being built by the G.W.R., and over it the Central London services will be extended eight miles from North Acton to Ruislip. Already the G.W.R. steam trains have been diverted to new tracks between Wood Lane and North Acton, thus giving margin for more frequent service of electric trains.

During the last twelve months, the widening of embankments and cuttings of the G.W.R. main line has been proceeding to provide room for the two new electrified lines between North Acton and Greenford, a distance of over 3 miles. The preparation of the ground to carry these new lines is well under way and good progress has been made with the retaining walls. The scheme has involved the construction of a "fly-under" bridge under the present electric lines near North Acton, a viaduct at Brentham over the River Brent, and another over the steam lines near Perivale. In addition nine other bridges are nearly completed, and a further viaduct a quarter of a mile long and three more bridges at Greenford are well in hand.

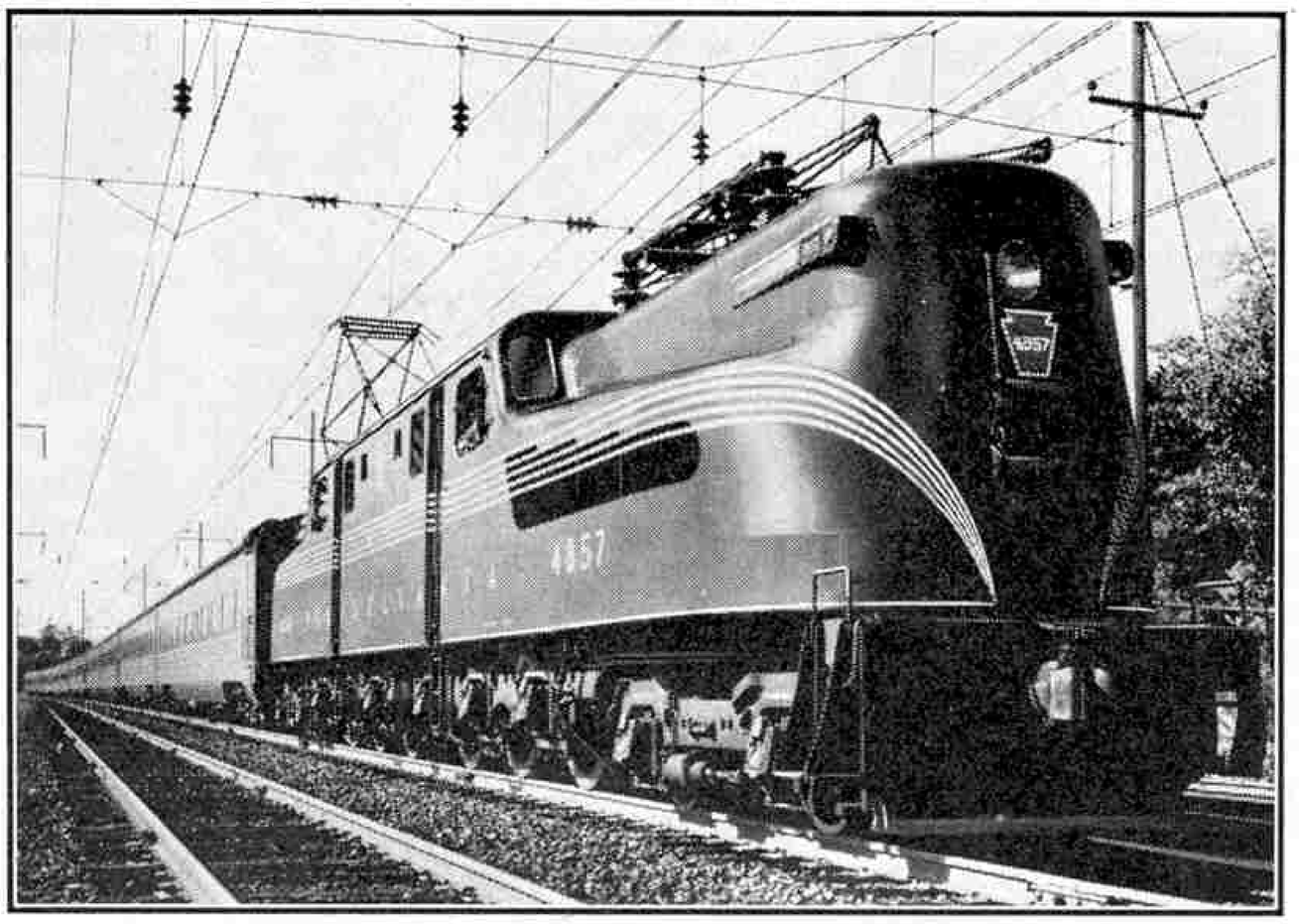
Early this year the two bridges at Alperton Lane and Horsendon Lane are to be rebuilt to provide wider roadways. To make this possible the steam-worked traffic will be diverted temporarily to the new electric lines between Brentham Viaduct and Perivale for a distance of approximately 1¼ miles.

At Ruislip the exterior work in connection with the big car depot is rapidly nearing completion. Work is now proceeding with the internal fittings of this depot, which is expected to be completed by the end of next Summer.

L.M.S. Locomotive Notes

Stanier standard locomotives are gradually extending still further their sphere of activities on the extensive L.M.S. system. Mixed Traffic 4–6–0s Nos. 5358 and 5362 of Class 5P5F were transferred from Perth to Oban recently for experimental working on the Callander and Oban line. Hitherto this line has been largely a stronghold of Caledonian types of engines, with the addition of the Highland "Clans" transferred to this route some time ago.

Another development of interest is that clearance tests with a Class 7 4–6–2 engine were recently carried out between Crewe, Chester, and Holyhead with a view to the use of these locomotives on the *"Irish Mail"* service. It is not at present intended to introduce regular workings.



A giant streamlined electric locomotive hauling the "Broadway Limited." A special article describing this train appears on page 19. Photograph by courtesy of the Pennsylvania Railroad.

Further 4–6–0 Mixed Traffic engines Nos. 5456–5461 have been built at Crewe, and 2–6–4 Passenger tanks Nos. 2636–2638 have been built at Derby.

The components of the articulated Diesel train are now included in Rail Motor Stock as Nos. 80001, 80002 and 80003.

Four "George the Fifth" engines Nos. 25298 *"Dragon,"* 25324 *"John Bateson,"* 25331 *"J. P. Bickersteth,"* 25374 *"Vanguard"* and two "Prince of Wales" 4–6–0s Nos. 25732 and 25787 have been condemned.

For these items of information we are indebted to Mr. D. S. Barrie.

Faster Goods Trains on L.M.S.

The L.M.S. announce the acceleration of 16 additional freight trains. Of the accelerated trains 12 are on Scottish services, including Glasgow–Carlisle, Aberdeen–Perth, Aberdeen–Carlisle, Glasgow–Edinburgh, Hamilton–Dundee, Perth–Inverness and Inverness–Wick. The greatest individual speed-up is 148 minutes in the running of a freight train from Abergavenny to Bushbury (Wolverhampton).

L.N.E.R. Electrification News

The L.N.E.R. have recently placed three large contracts in connection with the electrification of the line from Liverpool Street to Shenfield, together with the connecting line from Fenchurch Street to Stratford. The first contract involves the supply of new signalling apparatus for use between Liverpool Street and Bethnal Green. The signalling on this section is at present manually operated, but the new signalling will be entirely electric.

The second contract covers the construction of a fly-over viaduct at Aldersbrook, between Manor Park and Ilford. There are four tracks on this section of line; trains on the local lines bound for Liverpool Street have at present to cross the up and down through lines to reach their platforms at Liverpool Street Station, thus blocking the through lines in the process. The new fly-over viaduct will avoid this as it will carry the local lines over the through lines.

The third contract is for the construction of a retaining wall, booking hall and so on, at Stratford. Heavy works are in progress there. New platforms are to be provided for "tube" trains, which will come to the surface at Stratford Station, and new platforms are also to be built to accommodate the electric "shuttle" services that will eventually operate between Fenchurch Street and Stratford. All the platforms for tube trains, L.N.E.R. electric trains and L.N.E.R. steam trains will be on the same level.

Exhibition of Famous Trains in Miniature

Our London readers, and those who visit the city during the Christmas holidays, will be able to see a splendid Exhibition of famous British trains in miniature at the Charing Cross Underground Station. This commenced on 19th December 1938, and will remain open until 14th January. It has been arranged by the four main line railways in conjunction with the L.P.T.B.

The main exhibit consists of a modification of the scenic diorama with electrically controlled trains that formed part of the British Railways' Pavilion at the Empire Exhibition at Glasgow. The model trains were built to scale by Bassett-Lowke Ltd., at Northampton.

A Speedy L.M.S. Compound Run

A remarkable run was made recently between Glasgow and Perth by L.M.S. Standard Compound No. 1128, in charge of Driver Jeffries of Balornock shed, on the 2.15 p.m. express from Buchanan Street to Inverness. The work with the usual load of six coaches or 195 tons behind the tender was excellent from the start, yet it showed no signs of the heights of brilliance that were to be attained before Perth was reached. Up the stiff rise out of Glasgow, 1 in 79 at first and then easing to 1 in 98, speed rose to 32 m.p.h. in three miles of climbing; but then came signal checks and Larbert, the first stop, 22.1 miles from Glasgow, was reached a minute late in 32 min.

Then came a lightning restart, with speed rising to 58½ m.p.h. in two miles; in spite of a 25 m.p.h. slack over the site of a colliery subsidence at Plean the sharp timing of 11 min. start-to-stop for the 8.1 miles from Larbert to Stirling was practically observed. A particularly fine feat was to mount the two miles at 1 in 126 from Alloa Junction to Plean summit with a drop in speed only from 58 to 50 m.p.h.

It was on the concluding and hardest section from Stirling onward that the driver got such wonderful work out of his engine. After two miles of level comes the formidable Dunblane bank of 5¼ miles inclined mostly at 1 in 100, but including 1¾ miles at 1 in 88. Getting away from Stirling in great style No. 1128 reached 54 m.p.h. before striking the bank; then speed fell off very gradually. Bridge of Allan was passed at 50 m.p.h., Dunblane, half-way up, at 44½ m.p.h.; the 1 in 88 length lowered the pace to 41 m.p.h. but on the final stretch to the summit at Kinbuck the engine accelerated splendidly to 45 m.p.h. again! Thus Kinbuck, 7.6 miles, was passed in the exceptional time of 10¾ min. The easier but continuously rising length onwards to Gleneagles, 9.6 miles of it, took a modest 10¼ min.

Driver Jeffries took No. 1128 pell-mell down Strathearn, touching 82 m.p.h. before Dunning, and averaging 73 m.p.h. for 10 miles. Hilton Junction, 31 miles from Stirling, was passed in 32¾ min., a remarkable time in view of the ascent of Dunblane bank. With a cautious run in, complicated by several crossovers, Perth was reached in just 37 min. from Stirling, a gain of 4 min. on schedule.

We are indebted to Mr. O. S. Nock for these details.

* * *

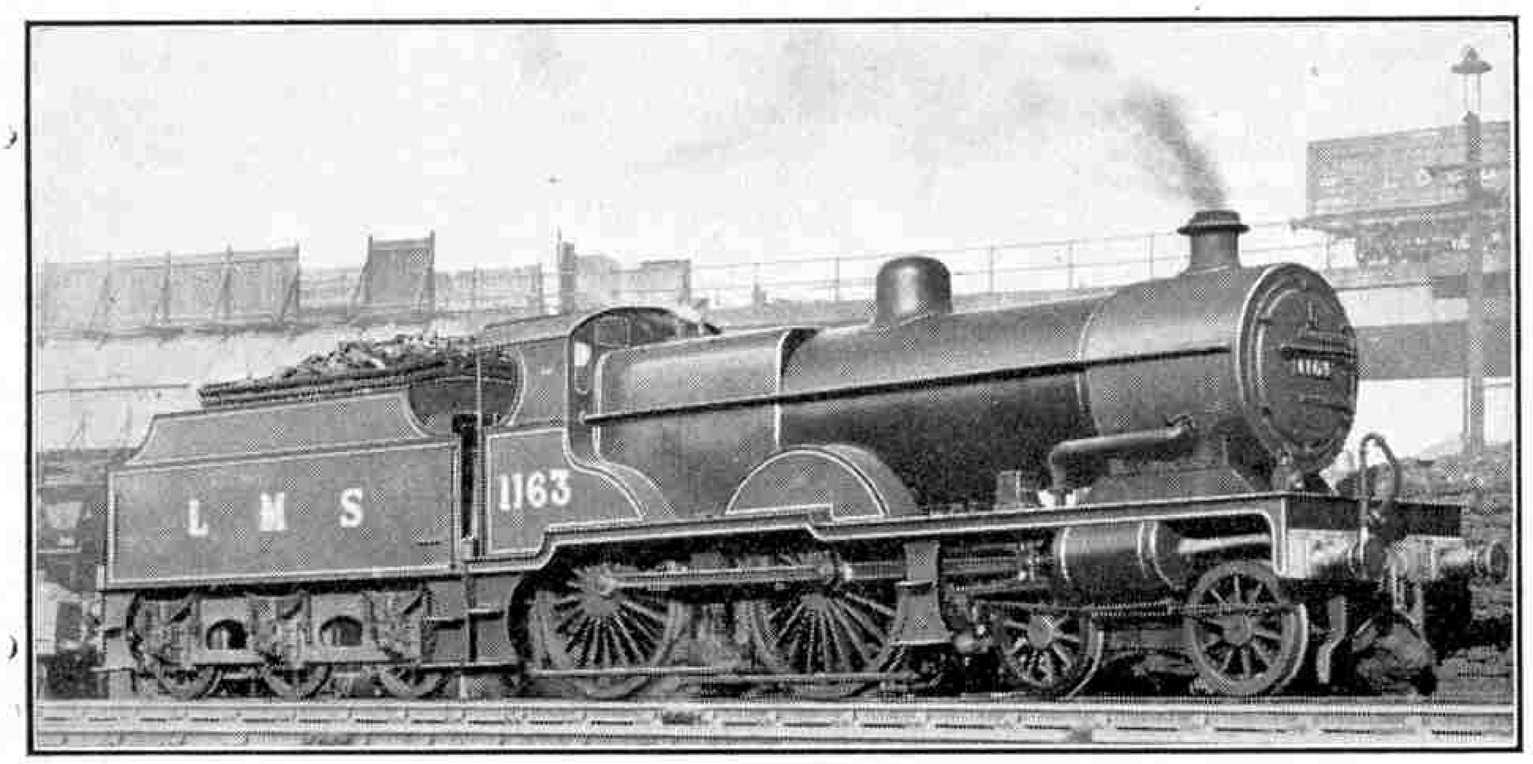
During this year the L.N.E.R. propose to break up 158 locomotives of various types, and build 50 tender engines of the 2–6–2 "Green Arrow" class.

Smart Emergency Working at Paddington

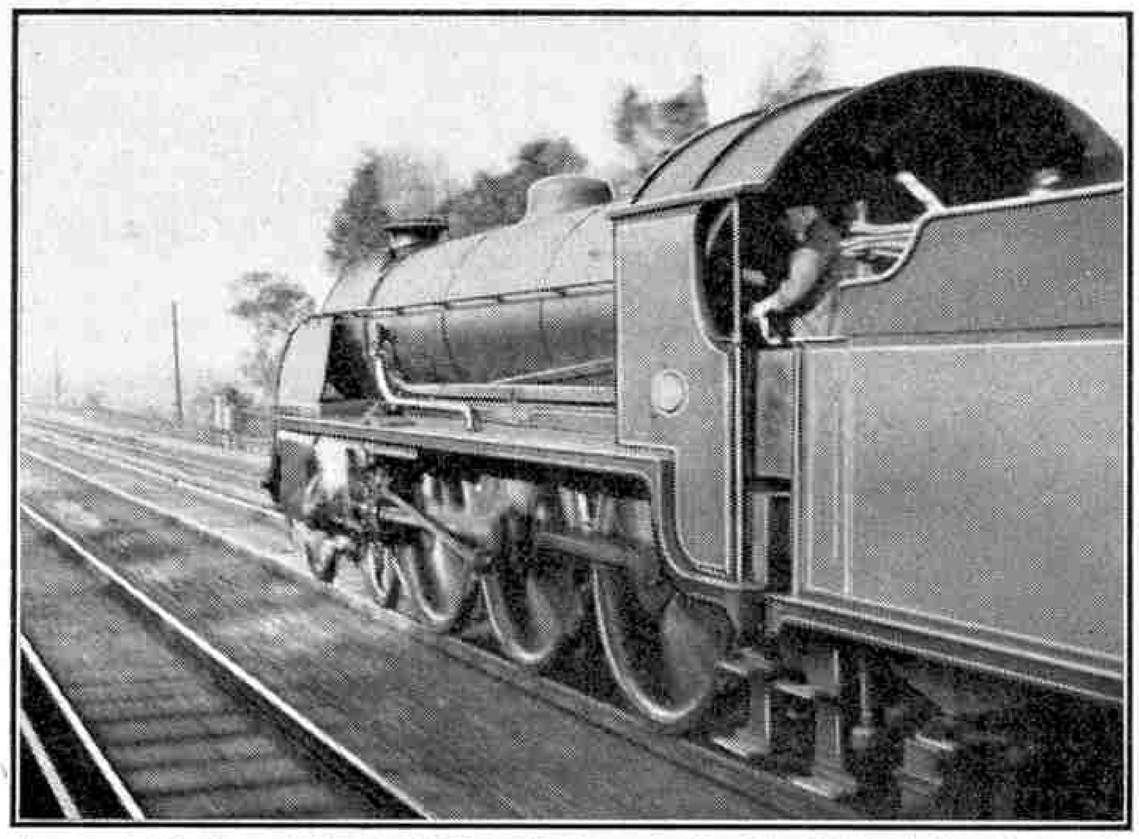
A destructive fire occurred in the G.W.R. main line arrival signal box at Paddington in the early morning of November 25th last. For all practical purposes the box was entirely destroyed and will take many months to replace.

Emergency arrangements had to be set up for dealing with the 850 trains in and out of Paddington daily. The alarm was given at 2.15 a.m. and, as a result of an urgent call to all stations as far as Newbury, relief signalmen and pointsmen were rushed to Paddington to take over the hand signalling that had to be instituted between Ealing and Paddington. Traffic and signalling experts were on the scene of the fire by 3.0 a.m. and temporary working arrangements were in force before 9.0 a.m.

Writing in the *"Railway Gazette"* recently Mr. Cecil J. Allen recorded that in spite of this handicap the *"Cheltenham Flyer"* was brought into Paddington on time only four days after the fire under the able management of Driver Street, who was making his last run with that train prior to retirement. Energetic running resulted in a clear 5 min. in hand at Ealing Broadway to offset delays to be expected nearer the terminus. Two checks and one dead stand followed, but the train was in Paddington at 5 p.m. as a result of enterprising driving.



L.M.S. Standard Compound locomotive No. 1163 at Edge Hill. The overhead gantry in the background forms part of the locomotive coaling plant. Photograph by the Rev. E. Treacy, Liverpool.



A remarkable view of S.R. 4-6-0 No. 742 "Camelot" of the "King Arthur" class. In this photograph, which was taken by W. P. Conolly, London, from a train travelling on a parallel track, the driver is seen "notching" up his engine.

"The Railway Handbook" 1938-39

The fifth annual edition of *"The Railway Handbook"* is now available, and forms a reliable source of facts and figures for the railway enthusiast. In the main the details apply to railways in Great Britain and Ireland, but the section on the electrification of steam railways gives details of changes of this kind in all countries. In its general make-up the book follows the same arrangement as in the two previous editions, and includes tables of fastest runs, longest tunnels, steepest gradients and so on. There are also interesting sections dealing with railway speed records, locomotives, carriages and wagons, permanent way and signalling.

A new feature this year is a table showing various locomotive wheel arrangements and the names that are in use describing them. There is a useful index, and an examination of the book confirms the claim of the publishers that it forms the only source of reference at so low a price for much of the information given in it. It costs 2/6 and is published by The Railway Publishing Co. Ltd., 33, Tothill Street, Westminster, London S.W.1.

A Famous American Train Streamlined

The *"Capitol Limited"* of the Baltimore and Ohio Railroad, the only Diesel-powered all-Pullman train in the eastern United States, is now completely streamlined. The train has been running for more than 15 years between Baltimore, Washington and Chicago. It now displays from end to end the striking blue, grey and gold colour scheme that has been so much admired on the Baltimore and Ohio streamliners operating between Washington and New York. The cars have rounded roofs and deep skirting on the sides between the bogies.

The interior of the train is modernistic in furnishing and decoration. The sleeping cars are decorated and upholstered in a specially attractive manner. Lighting is on a new system, heavy ground-glass bull's eyes covering the lighting clusters and panels, thus preventing glare while giving a diffused glow of unusually high candle power at reading distance. One of the most attractive innovations is a soft chime signal for calling porters instead of a loud electric bell. To meet the popular demand for privacy in train travel an unusually large number of bedrooms, compartments and drawing rooms have been provided. Some of these are specially arranged for family travel.

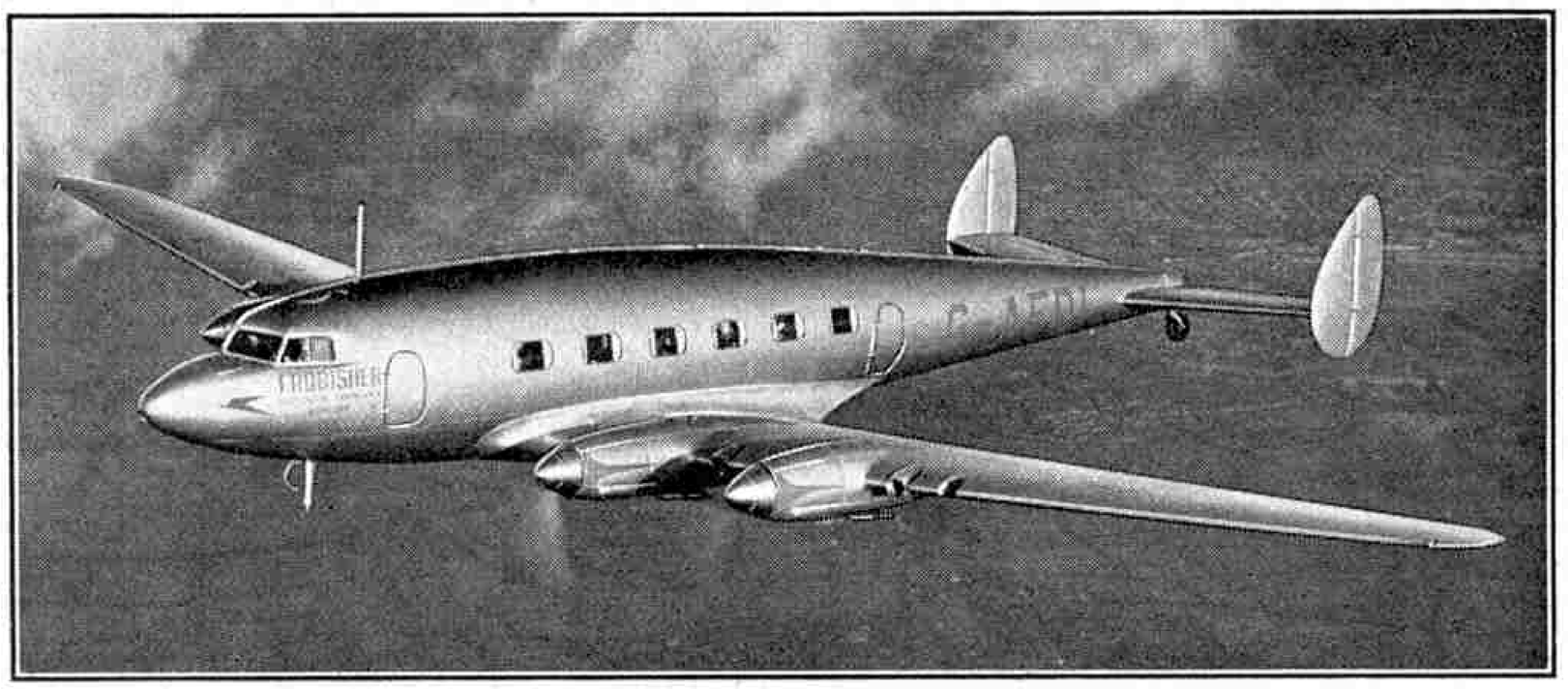
Before leaving Washington on its first trip as a streamliner the train was christened by Miss Tallulah Bankhead.

The D.H. "Albatross" Monoplane

New High-Speed Passenger or Mail Carrier

UNTIL last year the largest commercial aircraft produced by the de Havilland Aircraft Co. Ltd., was the "Express Air Liner," a type of four-engined biplane supplied in 1934 to Imperial Airways and Quantas Empire Airways. Now the company have introduced another four-engined air liner, the D.H. "Albatross" low wing monoplane, shown in the accompanying illustrations. It is their 91st design, and is very much larger and faster than the "Express Air Liner," is beautifully streamlined in the modern manner, and is the finest job the company have turned out.

There are two passenger versions of this new aeroplane. One is equipped only for daytime service and is called the "Albatross Transcontinental Liner"; the other is equipped also for night travel and is appropriately named the "Albatross Nightrider." A third, or mail-carrying, version is called the "Albatross Intercontinental Mail," and two machines of this type have been built for the British Air Ministry for transatlantic flying this year.



The first of the Imperial Airways "Frobisher" or "F" class air liners. These are the day type of D.H. "Albatross," and seat 22 passengers. This photograph and the lower one on the next page are by courtesy of de Havilland Aircraft Co. Ltd.

Imperial Airways are acquiring five of the day type aircraft, and these will be known as the "Frobisher" or "F" class in the company's fleet. The first of these, named "*Frobisher*," went into service in November last, and soon came into the news by flying from Brussels to Croydon in 67½ min., which was 20 min. less than the previous best time achieved on this route by an Imperial Airways machine. Later the liner, with 17 passengers on board, flew from London to Paris in 53 min., averaging nearly 228 m.p.h. This was a new speed record for commercial aircraft on this route. A fine miniature reproduction of this graceful air liner has just been added to the Meccano series of Dinky Toys Aircraft, and further details are given on page 66.

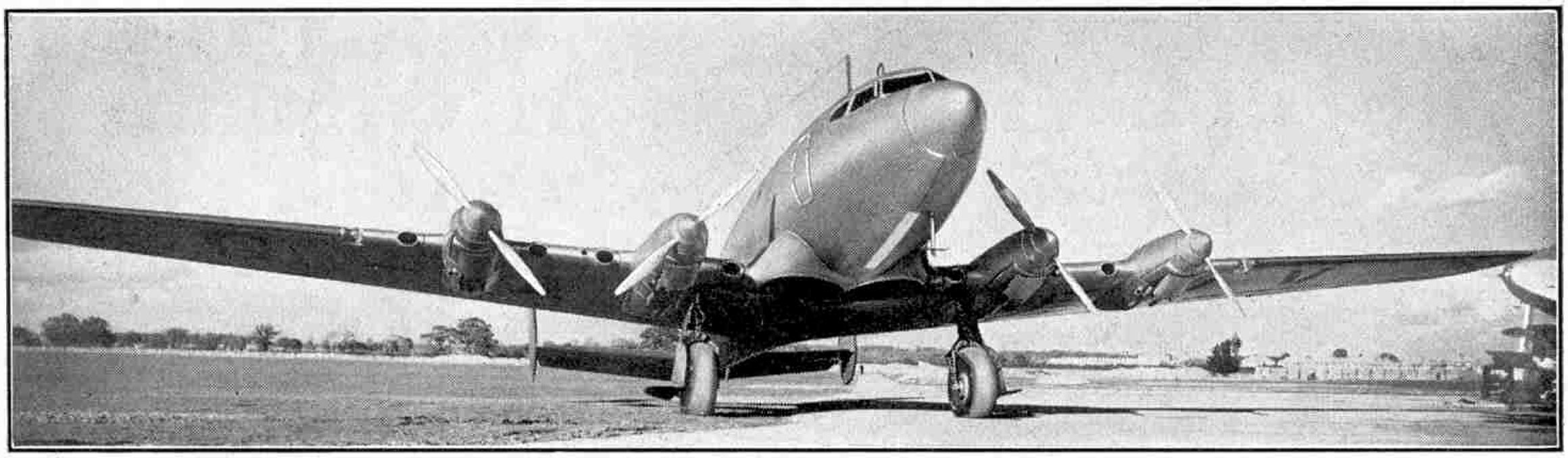
The day type "Albatross" seats 22 passengers in a lofty saloon divided into three roomy compartments, with a main entrance at the rear. Each of the three main compartments has an emergency roof exit that also acts as a roof light. A separate and front entrance is provided for the crew, who usually total four, the captain, first officer, radio operator, and a steward.

The windows in the passenger quarters are non-splintering and non-inflammable; in an emergency they can be pushed completely out. They are 2 ft. 4½ in. wide, and are so placed in relation to the pairs of seats facing respectively fore and aft, as to ensure the most extensive views. They are effectively curtained to exclude tropical sunshine when necessary, and to counteract brilliant sunshine the upper surface of the wing is treated with a special glare-absorbing finish. Large tables for serving meals can be fixed swiftly into place, and as quickly removed. Ventilation is by pure conditioned air that is temperature-corrected by steam heaters and is filtered, and can be regulated by the passengers. The air volume in both the passenger and crew quarters is changed completely 30 times an hour.

The "Albatross Nightrider" is designed particularly for transcontinental main line air services, and for routes that are served both day and night. The daytime equipment for 22 passengers can be converted into sleeper accommodation in a few minutes, while the aeroplane is being refuelled at an airport or while it is in flight. The night accommodation normally consists of 12 wide, soft-sprung single berths each 7 ft. long and arranged longitudinally, three upper and three lower berths on each side of a wide aisle. The four lower berths of the forward and amidships compartments are designed to provide beds of single or double width as required.

The "Albatross Intercontinental Mail" was produced to the order of the British Air Ministry. The contract stipulated that the aeroplane must be capable of transporting 1,000 lb. of mail a distance of 2,500 miles against a continuous headwind of 40 m.p.h. These conditions have been amply fulfilled, as with the required load and the full quantity of fuel on board, the aeroplane has a range, in still air, of 3,300 miles.

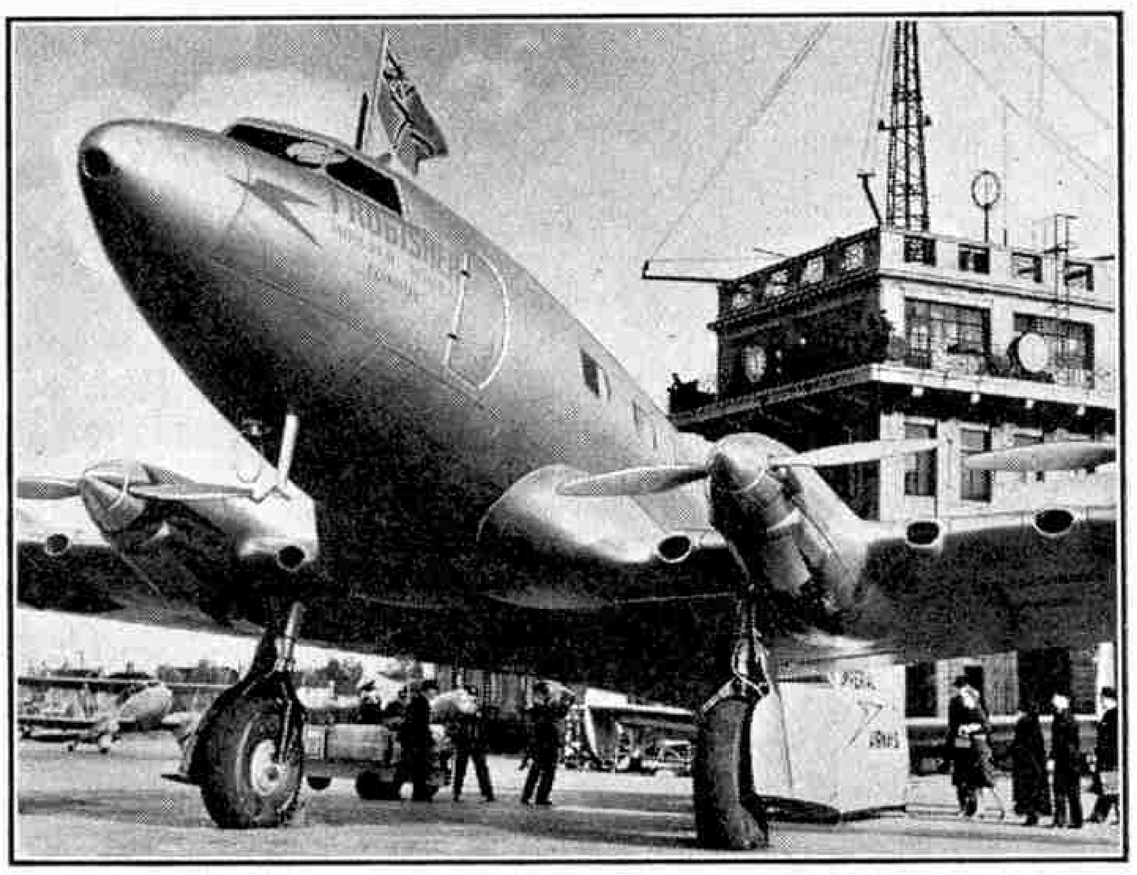
It is identical with the passenger type "Albatross" in all major respects, but of course lacks the luxurious furnishings of these aircraft. Instead, the two central compartments of the fuselage carry four 330-gall. fuel tanks, directly above the wing. They are provided with jettison valves, so that the fuel can be discharged in mid-air in an emergency. Resting quarters for the crew are arranged in the third compartment, in which also are stored flare chutes, bearing-compass fittings, marine equipment, etc. The large rearmost compartment is reserved for mails. Immediately behind the control and radio cabin are two rooms. The port side one accommodates the navigator and his chart locker and table, and the one on the starboard side is available for the stowage of mails.



One of the two long-range D.H. "Albatross" monoplanes built for the British Air Ministry. They will be used on an experimental transatlantic air mail service planned to begin this spring.

The equipment of the control cabin includes every modern aid to long-range navigation, and as in the passenger aircraft, there is an automatic pilot. An emergency electrical generator driven by a 1½ h.p. petrol engine is mounted in the navigation cabin, so that radio transmission and reception could be continued in the event of the aeroplane making a forced landing on the water.

The four engines of the D.H. "Albatross" are D.H. "Gipsy Twelves" of 525 h.p. and they drive de Havilland controllable-pitch, constant-speed airscrews. The use of four engines having a generous reserve of power above their output at cruising speed ensures a high degree of safety, and the "Albatross" carries its load and fuel at a normal cruising speed of 210 m.p.h., with its engines delivering only 62 per cent. of their take-off power. The engines are mounted in the leading edge of the wing, a pair on each side of the fuselage. Even with two engines on one side out of action, which is the worst possible combination in two-engine tests, the aeroplane will fly safely at a height of 5,000 ft. with full load. It will take off and climb to 14,100 ft. with full load, on three engines.



"Frobisher" viewed at close quarters. The openings in the leading edge of the wing are cooling air intakes, two to each engine.

There are slight differences in general performance between the passenger and mail-carrying types of "Albatross." The passenger types have a maximum level speed of 225 m.p.h. at 8,750 ft., and their service ceiling is 17,900 ft. The maximum level speed of the mail carrier type is 222 m.p.h. at the height just given, and the service ceiling is 15,100 ft.

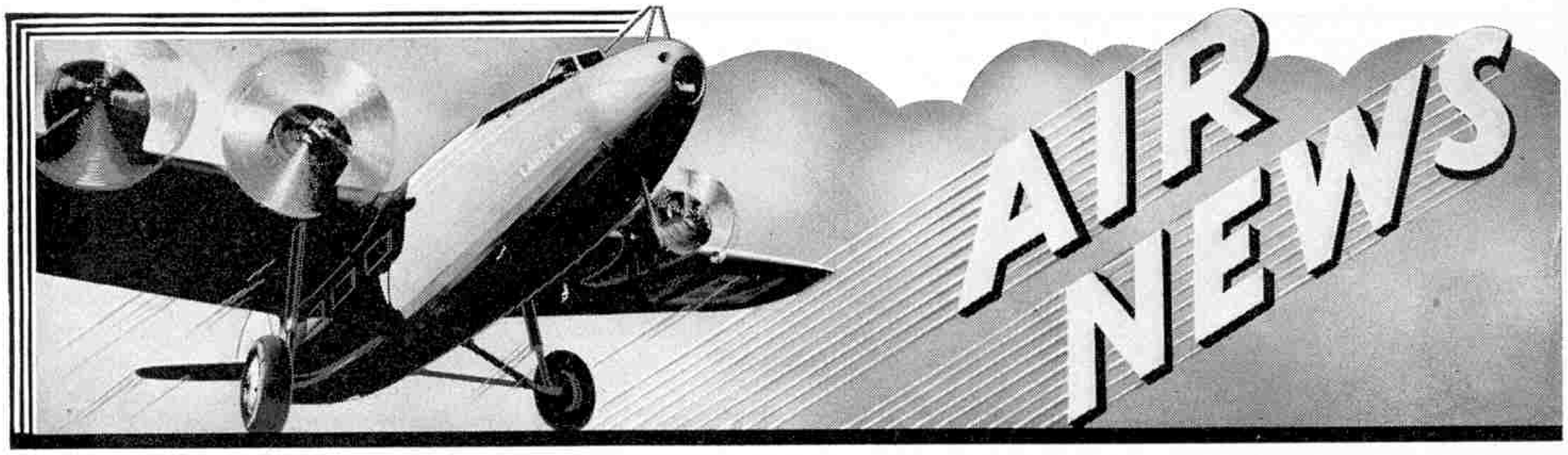
An interesting fact is that the development of the D.H. "Albatross" may be traced back to the special thin-wing multi-engine formula that was explored in the designing and building of the D.H. "Comet" racing monoplane. The many record flights made by that aeroplane since it won the MacRobertson England–Australia air race in 1934 have made both it and its fine pilots famous. The design and construction of the "Albatross" provided the desired greater scope for working out those ideas, and the main characteristics of the famous racing monoplane have been further developed in the new air liner.

The wing of the "Albatross," like that of the "Comet," is of wooden stressed-skin construction, and is 105 ft. in span. It is built in one piece and extends through the lower part of the fuselage, passing under the false bottom, and is secured in place by steel plates at the front and a steel tubular structure at the rear. The covering is of plywood. The wing is remarkable in having a thickness of only 2.1 per cent. of the span, resulting in a relatively high lifting capacity and at the same time low drag. The trailing edge is fitted with metal ailerons and electrically-operated slotted flaps. The tail unit has twin fins and rudders.

The fuselage is 71 ft. 6 in. long, with the tail up, and is of circular cross-section. It is an example of what is called "lobster claw" construction, and consists of a double stress-bearing shell of plywood, with a thick layer of balsa wood between the inner and outer walls, the whole being hermetically sealed by films of synthetic resin embodied in the two walls. This form of construction has been developed and patented by the de Havilland Company after very extensive research. In addition to having a remarkably high ratio of strength and stiffness to weight, it has the advantages of reducing vibration, absorbing sound, being easy to maintain, and of providing a surface free from rivets and lap joints, and on which any desired degree of smoothness can be obtained.

The control cabin is high up in the fuselage and well forward of the wings. It is roomy and quiet, and is not near to the plane of the airscrews. It has side-by-side seating for two pilots, and full dual control. The outlook provided for them is excellent, and the large side windows may be opened wide, giving clear forward and side views without admitting draught, however fast the aeroplane may be flying. A combined window and roof exit give a wide-angle upward view. The main control room windows are of shatterproof glass and are designed to prevent reflection, and they have anti-icing equipment. A scuttle shields the instrument panel, which is shock-proof.

The undercarriage is retractable, and it can be raised in 30 sec. and lowered in 20 sec.



American Transatlantic Survey Flights

American Export Air Lines, Inc., intend this spring to begin a series of transatlantic experimental survey flights between America and Europe, preparatory to introducing a regular scheduled service. The flights will be made from New York, and will chart air routes to the principal European countries, North Africa, and Asia Minor, and the countries concerned have granted permission for the flights. The routes to be charted will supplement the company's steamship services to the Mediterranean and Black Sea countries that have been operated for the past 20 years. Officers from the ships on these services are being specially trained in collecting and transmitting weather reports at sea, meteorological information, and in other navigational duties, and by the time the survey flights begin the crews of the ships will have had two years of this highly important training and experience.

During the survey flights the aircraft and the company's ships along the route to Europe will be in constant touch with each other, and the ships will act as flying observatories, transmitting up-to-the-minute weather reports and other navigational information to the pilots of the aircraft. The ships will serve also as mobile bases, on call at any time of the day or night.

The company have purchased a Consolidated PBY-1 flying boat for these survey flights, at a cost of £40,000. This aircraft is a 15-ton, semi-cantilever high wing monoplane, and is the first of its type to be built for commercial service. It is fitted with two engines, and is capable of over 200 m.p.h. at a height of 8,000 ft. A crew of six will be carried, and with 2,000 lbs. of payload on board, the flying boat will have a range of 4,000 miles.

Specifications for larger, faster, and more luxurious aircraft with which to operate a non-stop transatlantic passenger, mail, and freight air service, are already being considered by the company.

The Boeing "Clipper" Flying Boat

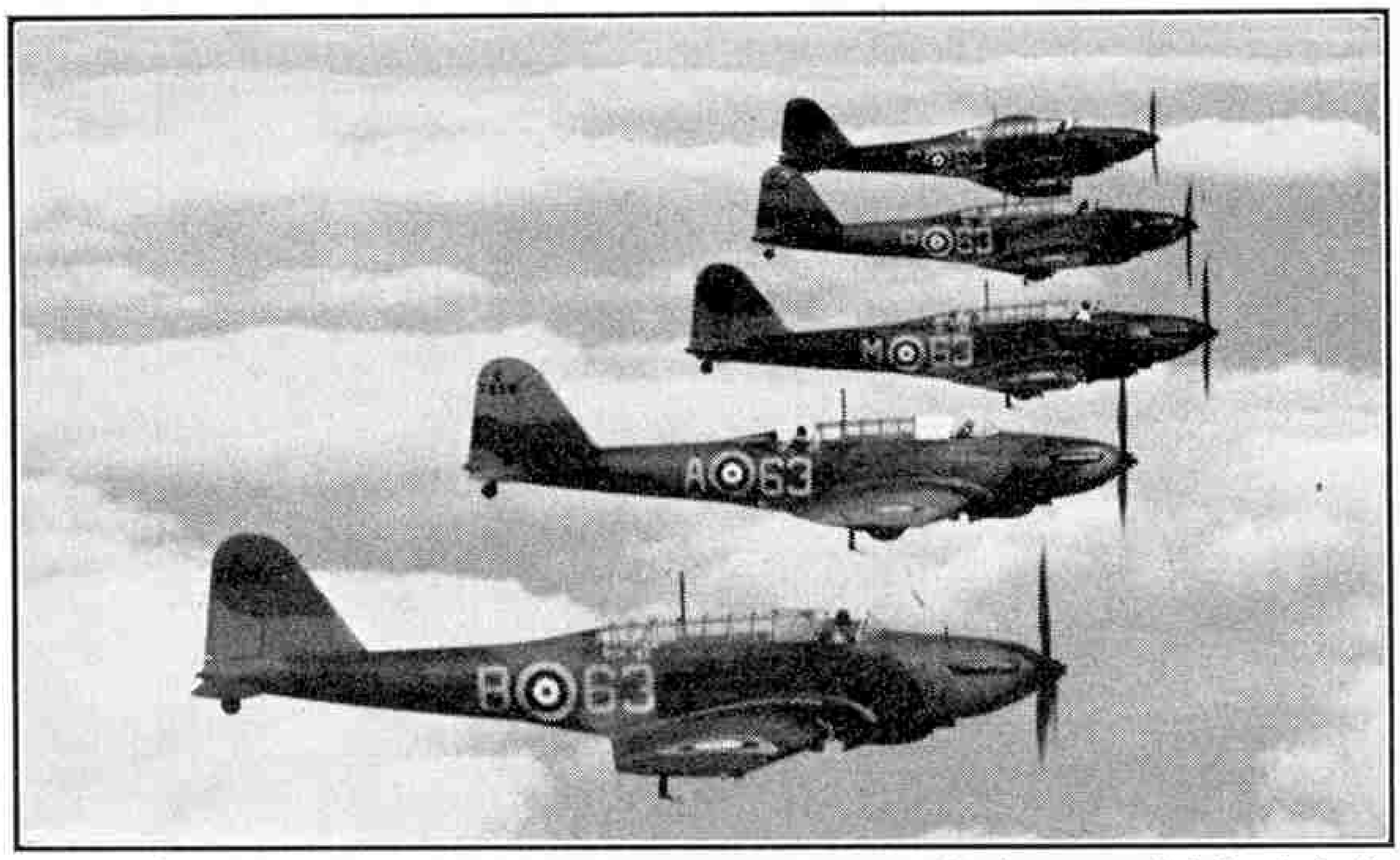
The extensive manufacturer's tests of the new 4-engined Boeing 314 "Clipper" flying boat, which were described in the October 1938 *"Air News"* pages, have been completed and have proved very satisfactory. The tests involved a total of 80 take-offs, about 5,000 miles of flying, and about 450 miles of taxying. A total of 100 precision instruments of various types were used in carrying out the temperature, pressure, and vibration tests.

The giant aircraft will now undergo its official trials for the Department of Commerce, which are equivalent to the tests an aeroplane in this country must undergo to qualify for its Certificate of Airworthiness. Most of the official tests of the Boeing aircraft will be made with it in flight, and they will range from altitude climbs to night flying.

The Boeing 314 "Clipper" is a high wing monoplane type flying boat fitted with four 1,500 h.p. Wright "Cyclone" engines. It has been built for Pan American Airways, and together with five similar aircraft now under construction it will be used by them for transatlantic and trans-Pacific service.

Transatlantic Air Mail Tests

The Air Ministry announced recently that it is hoped to begin an experimental air mail service this spring between this country, Eire, Canada, and the United States, as soon as the seaplane base at Botwood, Newfoundland, is free from ice. The decision is subject also to mid-air refuelling tests proving satisfactory. These tests are to be carried out by *"Cabot,"* one of the strengthened type of Empire flying boats of Imperial Airways. The D.H. "Albatross" monoplanes built for the Air Ministry will be used on this service. These aircraft are described on page 14.



R.A.F. Fairey "Battles" flying abreast. These streamlined two-seater bombers carry their bombs in the wings, and also are armed with two guns.

Fairey Company to Build New Type of Liner

After carefully considering designs submitted by leading aircraft producers for a new type of large, high-speed air liner, the Air Ministry have accepted the design of the Fairey Aviation Co. Ltd., and work on the machine is to begin immediately. It will be the first civil aeroplane produced by that company, and will be a 4-engined, low wing monoplane of stressed-skin, all-metal construction, with seating for 30 daytime passengers. The aeroplane will be capable of a top speed of about 275 m.p.h. and a cruising speed of 220 m.p.h., and with a full load of passengers on board it will have a range of about 1,000 miles.

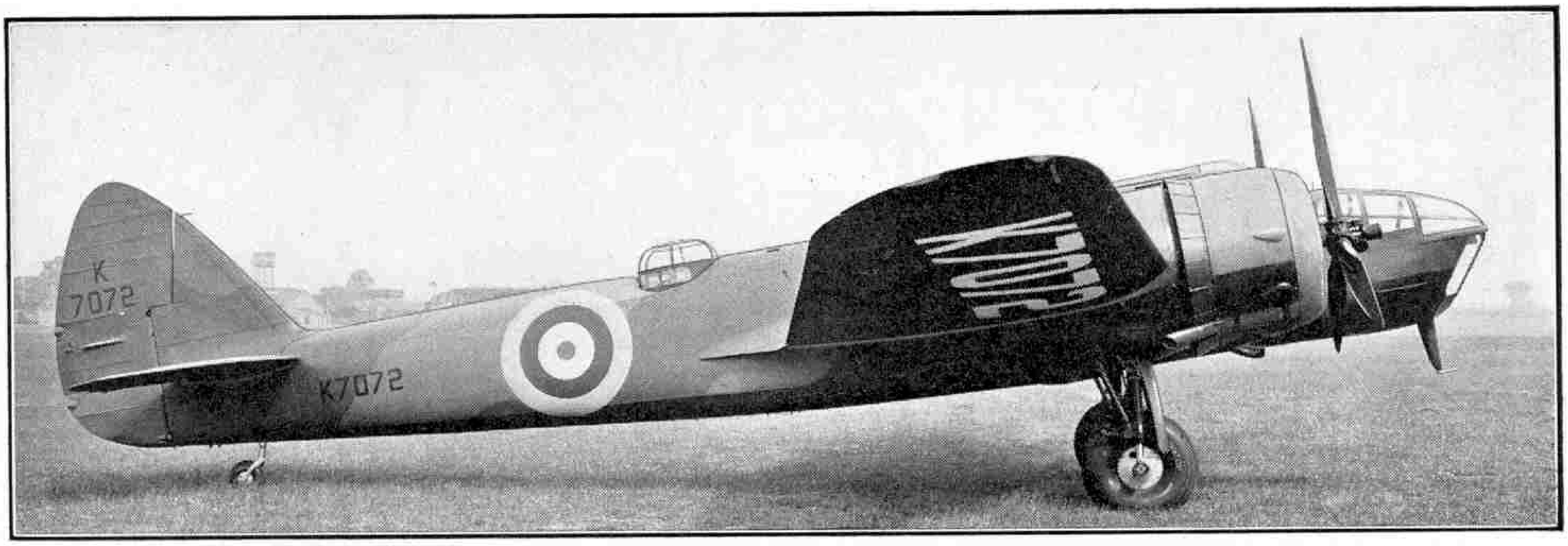
The new air liner has been designed for high-altitude flying so that the pilots will be able to fly at high speed above bad weather conditions, and the air pressure in the passenger cabins will be automatically maintained at that of lesser altitudes. The undercarriage of the aeroplane will be retractable, and will be of the 3-wheel type now coming into favour.

A Fine R.A.F. Flight

A fine non-stop flight from Penang to Trincomalee, Ceylon, was accomplished recently by three of the "Short Sunderland" flying boats sent out last year to the R.A.F. station at Singapore. The aircraft made the 1,400 miles sea crossing to Ceylon in 8¼ hrs. The "Sunderland" is the military version of the well-known Empire flying boats used by Imperial Airways.

Azores May Become Atlantic Air Base

Captain G. I. Thomson, a pilot of Imperial Airways, recently completed a thorough survey of mid-Atlantic conditions at, and in the region of, the group of islands forming the Azores. This was in connection with the possibility of the Azores being used as a stopping place on a commercial air service on the South Atlantic route. He visited each of the islands, surveyed aerodrome sites, and made observations as to sea conditions. Captain Thomson supplemented by notes from his own observations the reports provided by the meteorological department at Horta concerning cloud-height and visibility, and he also reported upon the wireless facilities available at Horta.



The new, long-nosed version of the well-known Bristol "Blenheim" bomber. The special shape of the nose has made more room available for the navigating and bomb-aiming equipment. Photograph by courtesy of the Bristol Aeroplane Co. Ltd.

A Faster Bristol "Blenheim"

One of the most interesting exhibits at the Paris Aeronautical Exhibition held from 25th November to 11th December last year was the new version of the well-known Bristol "Blenheim" Bomber. The most striking feature of the improved machine, shown in the upper illustration on this page, is the unusual shape of the nose, which has been extended to provide more room for navigating, etc. It now contains a chart table, instruments, and a folding seat, and the bomb-aiming facilities have also been improved. The special shape and construction of the nose gives an exceptionally good field of view.

This "Blenheim" is a special long-range bomber fitted with extra fuel tanks in the wings, and is designed to have a range of 1,900 miles in still air. It is fitted with two Bristol "Mercury VIII" engines, which are now available for use with a grade of fuel that enables their take-off power to be increased from the 725 b.h.p. of the standard "Blenheim" to 920 b.h.p. The aeroplane carries the same crew as the ordinary "Blenheim," consisting of a pilot, navigator and wireless operator-gunner, and also the same full load of bombs.

The top speed of the new aircraft is even higher than that of the standard type, of which there are already many hundreds in service, and the figure given as the nominal top speed for this latest version of the Blenheim is 295 m.p.h. This, together with the long range, makes the aeroplane one of the most formidable bombers in existence.

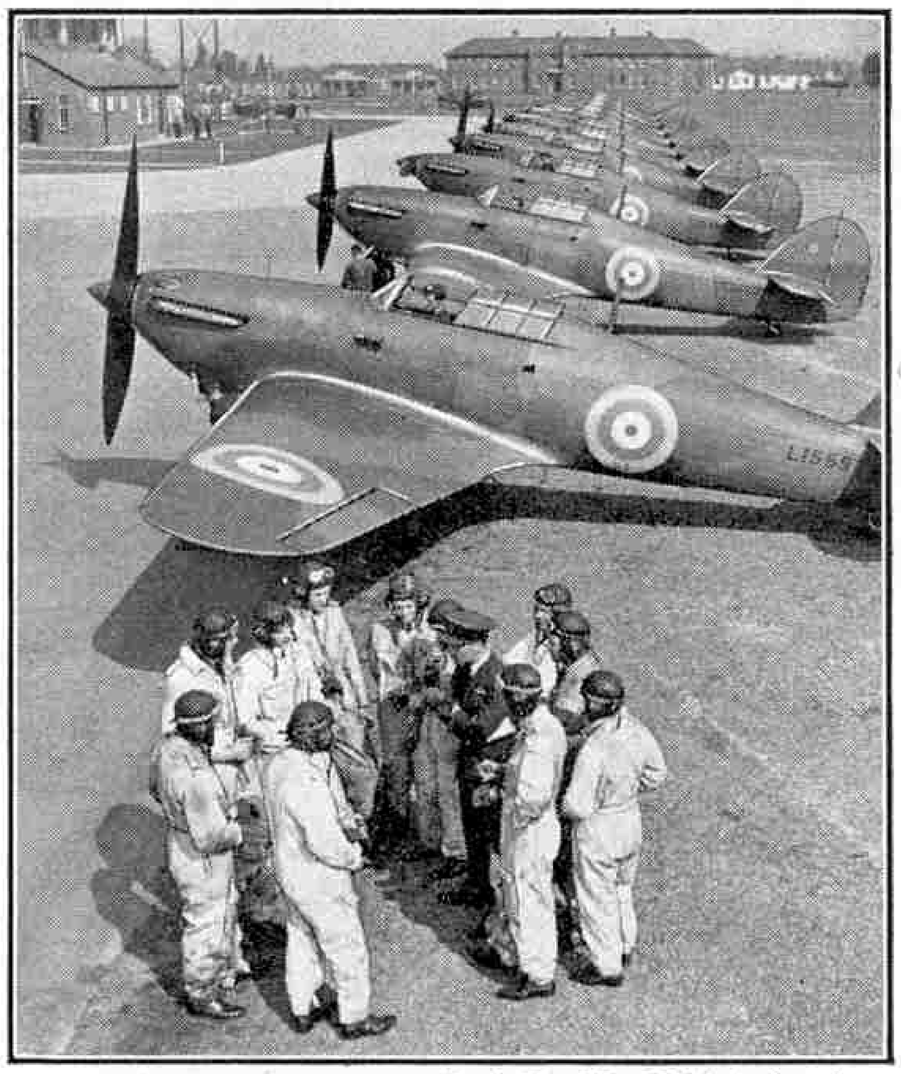
Big Canadian Air Transport Merger

A notable development in Canadian air transport was the recent amalgamation of 11 important air transport companies. Under a Government charter the air services of these companies will be operated by a single managing organisation which will have its headquarters at Winnipeg. A great deal of the air traffic dealt with by the companies consists of the transport of passengers and freight to mining, fishing, and oil districts in northern Canada, which owing to lack of railway transport and good roads were formerly very remote. It is believed that the new scheme will avoid wasteful competition and result in better service. The new organisation is called Passenger and Express Air Services Ltd.

Empire Flying Boats Take Off by Flare Light

During the short days of winter it is dark when the Imperial Airways Empire flying boats take off from Southampton on the South African and Australian services. The course the pilots must follow in taking-off is therefore indicated by a line of flares, each consisting of two battery-lit bulbs fixed to a mast mounted upon a buoy. The bulbs are amber-coloured, so as to avoid any risk of the pilots mistaking them for the navigation lights of ships.

The buoys, complete with flares, are brought from the shore in two launches, and are moored about 200 yds. apart in a line that marks off an ample area of clear water and leads into the wind. A launch stands by at each end of the line, or flare path, until the flying boat has taken off and it is evident that it is not returning owing to any unforeseen circumstance. The buoys are then collected and taken ashore, ready for use again.



Pilots and Hawker "Hurricanes" of No. III (Fighter) Squadron, R.A.F. This squadron was the first to be equipped with these streamlined fighters, which are designed to fly at over 300 m.p.h. Photograph by courtesy of "Flight."

The D.H. "Flamingo" Air Liner

A new de Havilland air liner of the high wing monoplane type has been completed. It is called the D.H. "Flamingo," and will seat 12 passengers and a crew of three. An alternative internal arrangement will provide accommodation for as many as 20 passengers. The "Flamingo" is a twin-engined aeroplane, and its two 850 h.p. Bristol "Perseus XIIC" engines will enable it to cruise at over 200 m.p.h. The undercarriage is retractable.

Berlin to Tokio in Two Days

An outstanding flight from Berlin to Tokio, Japan, was accomplished on the 29th-30th November last by a German Fock-Wulf "Condor" monoplane, which covered the distance of about 8,500 miles in 46 hr. 15 min. 52 sec. During the flight halts were made at Basra, Karachi, and Hanoi, and the aeroplane was manned by the same crew of five men who flew non-stop from Berlin to New York last August. The previous fastest flight between Japan and Europe was that of the Japanese monoplane *"Divine Wind,"* which in April 1937 flew from Tokio to London in 3 days 22 hr. 8 min.

During the return flight to Germany the "Condor" monoplane was forced down when crossing Manila Bay, in the Philippines, owing to the breaking of a petrol pipe. The aeroplane sank almost immediately in shallow water off Sunset Beach, a coastal resort. Two of the crew were rescued by a United States amphibian aircraft sent to the rescue from Manila Bay, 15 miles away. The other three of the crew and the only passenger, Herr H. Junge, a director of the Focke-Wulf company, the builders of the machine, were rescued by fishermen. The unfortunate "Condor" is to be salvaged, dismantled, and shipped back to Germany.

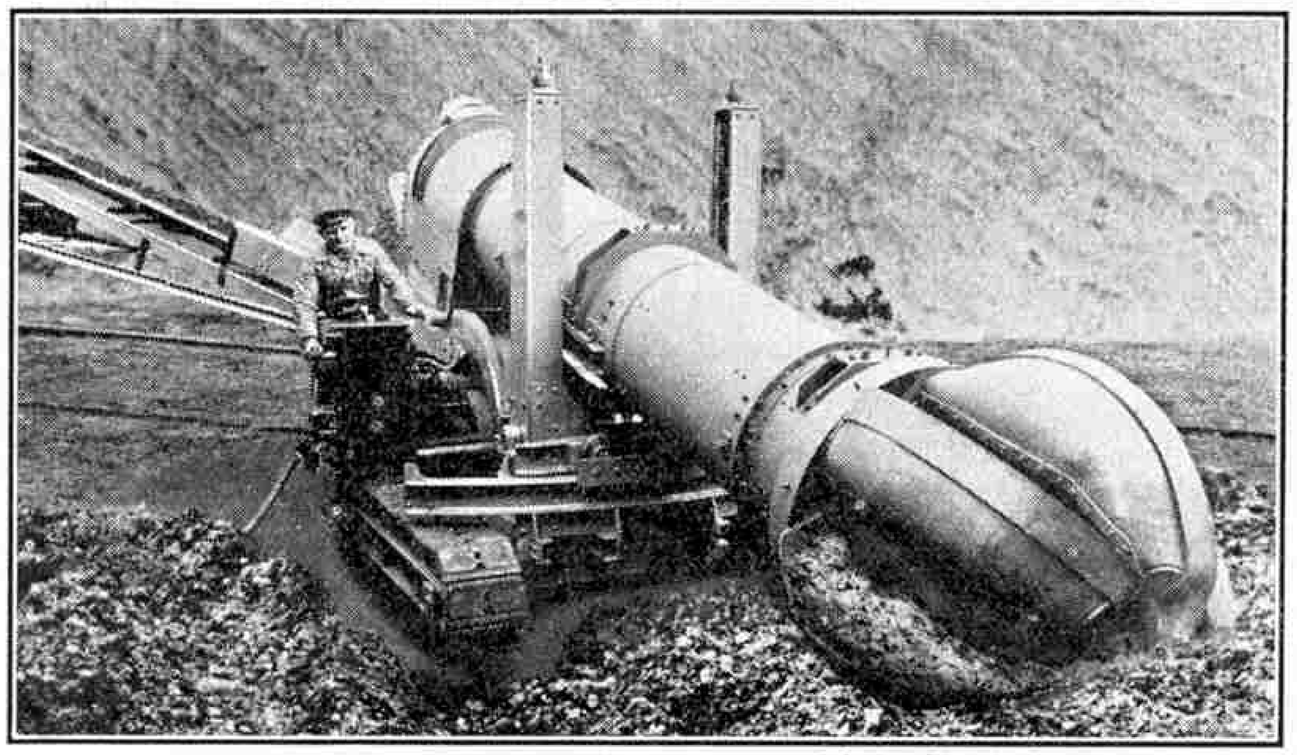
Proposed K.L.M. London-Australia Air Service

Plans are in hand by the K.L.M. company, of Holland, for a regular air service between London, Amsterdam, and Sydney, the journey time of which would be only 3½ days. If negotiations now being conducted with the Ceylon Ministry of Communications are successful, the air route operated will be by way of Karachi, Colombo, and Sumatra. This will avoid flying across India and down the Malay Peninsula.

Rotating Ball That Scoops Up Earth

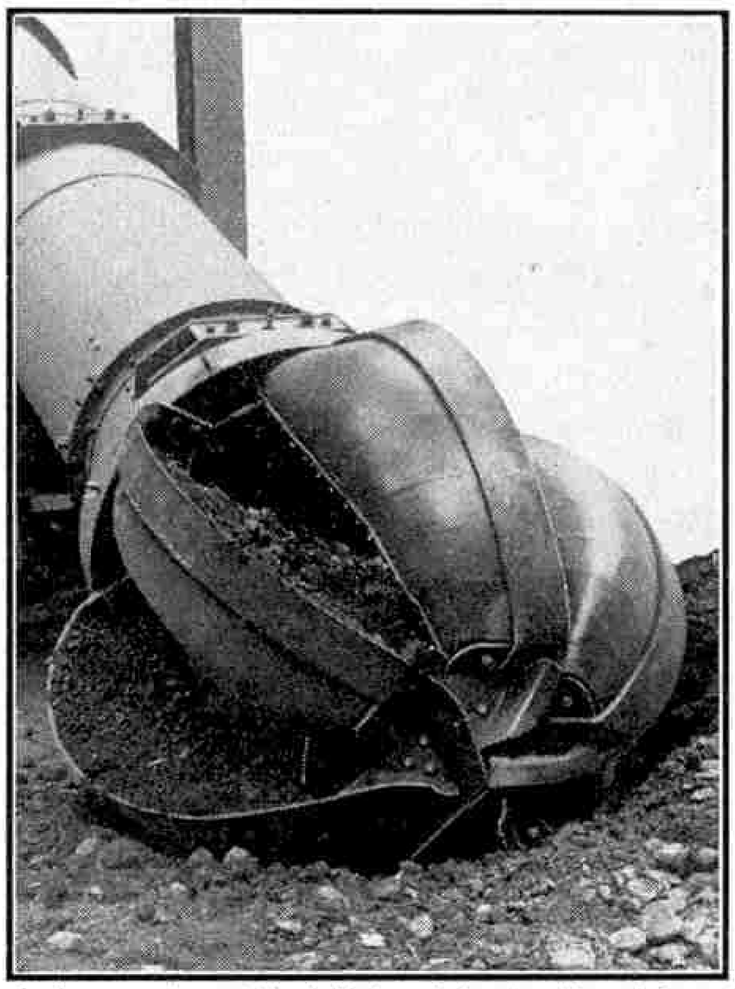
A New Type of Power Shovel

THE strange machine shown in the illustrations on this page is a new appliance for removing quickly large quantities of loose material such as gravel, sand, coal and coke, or the heaps of spoil that accumulate at pitheads and during excavation work of all kinds. It has been introduced by Bleichert-Transportanlagen G.m.b.H., by whom it was shown at the Leipzig Fair of last year, and on account of the curious shape of the unit that gathers in the spoil is known as the Bleichert Ball Excavator.



A Bleichert ball shovel at work removing a heap of loose material. The illustrations on this page are reproduced by courtesy of Bleichert Transportanlagen G.m.b.H., Leipzig.

The very appearance of the machine immediately attracts attention, for it looks like some prehistoric monster as it thrusts its head into a pile of spoil, with its rotating scoops eating up and whirling away the material on which it feeds. It is no less interesting from an engineering point of view. The work that it is designed for is most frequently carried out by means of endless chains of digger buckets. These have the disadvantage that there are in them a very large number of moving parts and joints, fishplates and bolts, all of which are subject to heavy wear and tear, and another drawback is that special feeding usually is necessary to bring the material up to the travelling buckets to enable them to dip into it and carry it away. Both these troubles are avoided by the use of the Bleichert Ball Shovel, which can turn its head from one side to the other so as to sweep over a large area in front of it, and can also lift it to a height so as to take up material from the top of a heap instead of the bottom. The chain bucket loader usually works at the foot of a heap, and if the material remains caked together instead of sliding, there is risk of spilling owing to the sudden slipping of large masses. This does not happen with the Bleichert Ball Shovel, which can readily draw down material from the top. The new machine in fact acts on the digger principle, and possesses the great advantages of such working, including trifling wear and tear and high output with great flexibility.



A close-up view of the ball shovel showing the reinforced edges of the scoops.

The machine is mounted on creeper tracks, and thus can rapidly be moved when it has cleared away all the material within immediate reach of its devouring head. It is electrically operated, and easy to control, and the blades or scoops of its rotating shovel-head are readily interchangeable. Their action is swift and easy, and they pick up and move such material as coal and coke without crushing it.

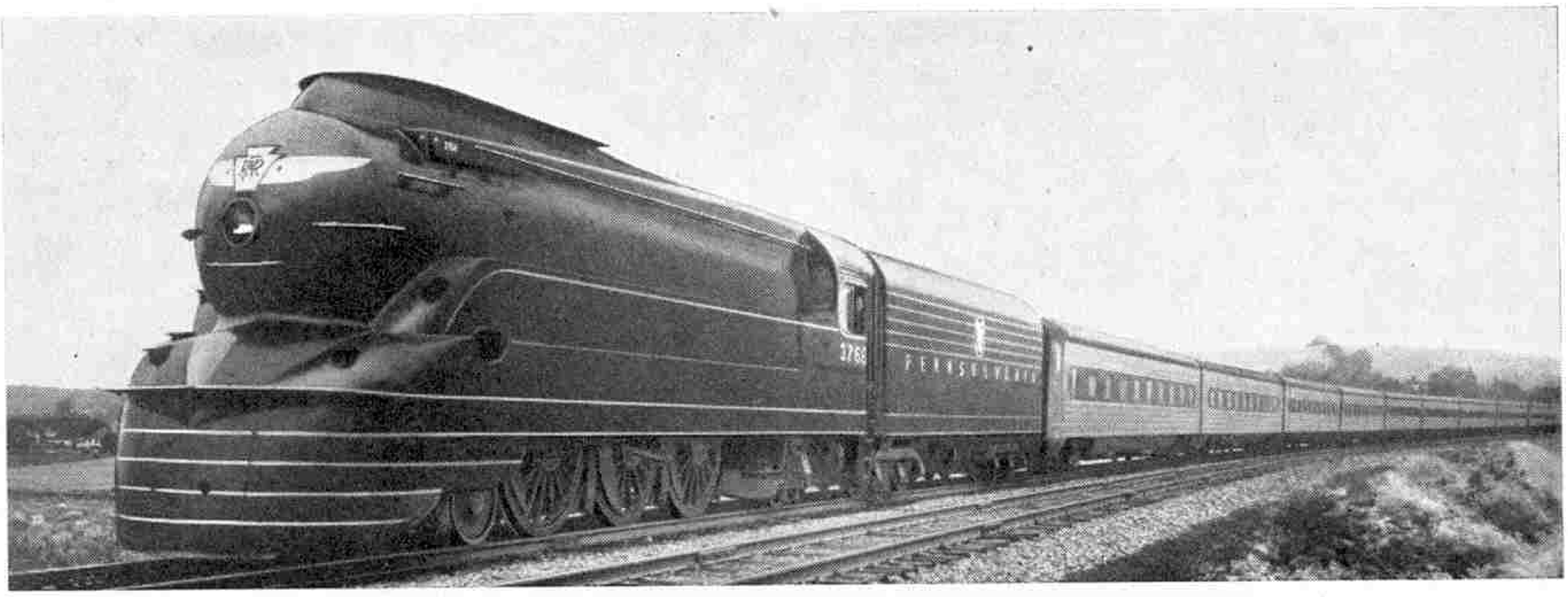
The main feature of the ball shovel is a steel tube or barrel of large diameter mounted on a motor-driven chassis. Inside the barrel is a travelling belt conveyor, and at its head is a steel ring rotated by a 6 h.p. electric motor, the drive of which is transmitted by means of a long shaft passing along the tube above the conveyor. It is this ring that carries the ball shovel, the surface of which is divided into six sections shaped to form curved scoops. The man in charge sits at the side of the tube, with all the controls within reach, and at his bidding the scoops are pushed into the material to be moved. They make six revolutions a minute, picking up the spoil as they turn, and when each reaches the highest point of the ball its contents fall out on to the conveyor band, guide blades directing the material so that none is spilled. The conveyor then carries this to the rear of the machine, where it is discharged directly into waiting trucks if these can be brought up to the machine at a suitable level, or on to travelling belts that take it to the delivery point.

To enable the head to move from side to side, and to be raised to the height required to take material from the top of a heap, the barrel is mounted between stout steel uprights carried on a swivelling base. These movements also are electrically operated, and the motors concerned, like others installed in the machine, are controlled by means of the latest switch devices, making every movement easy to manage. The current consumption is low.

The shovel is capable of moving spoil at the rate of 70 to 140 cu. ft. an hour, and the many different kinds of work to which it can be put make it particularly valuable. Those already suggested do not exhaust the possibilities, for it can be supplied as a digger for excavating such deposits as sand or gravel and for use on building sites.

More American Streamlined Trains

The "*Broadway Limited*" and other "Pennsylvania" Flyers



REMARKABLE progress has been made during the last few years in the United States in the development of more and more advanced passenger equipment for long distance services. We have in several recent issues described such famous transcontinental expresses as the "*City of Los Angeles*" and "*City of San Francisco*" of the Union Pacific, and the "*Super Chief*" of the Atchison, Topeka and Santa Fé Railroad, and their special equipment provided for long distance travel.

The streamline vogue also has spread to the Eastern States. "*Railway News*" this month chronicles the streamlining of the "*Capitol Limited*" of the Baltimore and Ohio Railroad; and the New York Central, and the Pennsylvania lines have had in use for some time streamlined expresses on their services between New York and Chicago. The streamlined "*Twentieth Century Limited*" of the New York Central was described in the "*M.M.*" in November last; now we have to deal with the latest development on the Pennsylvania system.

New stock has been provided for four of the most famous trains of the Pennsylvania line, with the result that these have been described as "a fleet of modernism." The leader of this splendid quartette is the old-established "*Broadway Limited*," which runs between New York, Philadelphia and Chicago, providing an overnight service occupying 16 hours. This is a record time for the journey that came into force during last year when the new trains were introduced. A special reputation has always been enjoyed by this service of the Pennsylvania Railroad, which claims the shortest route between East and West.

The exterior of the new "*Broadway Limited*" is striking. Being assembled by welding the steel roofs and sides of the various vehicles are quite smooth in outline. Combined with the absence of any structural projections and the provision of the inward curving "skirts" below the car bodies, this gives the train a harmonious, graceful effect that is well set off by the gold striping and lettering on the standard Tuscan red livery of the Pennsylvania.

In its travelling qualities too the train is as good as its appearance suggests. Special bogie trucks ensure smooth running, felt insulation reduces the noise, and tight-lock couplers with rubber-insulated drawgear eliminate the slack between individual cars permitted by the ordinary type of American coupler. Thus the whole train moves forward or is retarded as a complete unit, and the comfort of travel is correspondingly improved. This is a matter of special importance with the high average speeds that are required of the "*Broadway Limited*" between stops. The time allowed over the 76 miles between Newark and North Philadelphia, for instance, is only 66 min. which means an average start-to-stop speed of 69.1 m.p.h.

The "Broadway Limited" of the Pennsylvania Railroad hauled by streamlined "Pacific" locomotive No. 3768. This train runs between New York and Chicago, and is of very striking appearance, its smooth external contours being well shown up by its Tuscan red livery and gold lining and lettering. For this photograph and for the information in the article we are indebted to the Pennsylvania Railroad.

The run just mentioned is attained by electric traction, for the "*Broadway Limited*" is partly steam-hauled and partly electric. The run between New York and Harrisburg, an important junction, is made over the electrified main lines, the equipment of which as the greatest electrification scheme in the world was described in the "*M.M.*" for October 1937. The engines employed over this section are streamlined giants classed as GG-1, and they can haul heavy trains at sustained speeds of 100 m.p.h.

Between Harrisburg and Chicago, beyond the electrified zone, steam power is employed in the shape of specially streamlined K4S "Pacific" locomotives, the most recent development of a class well-tried in Pennsylvania service, the K4S. One of these is shown at the head of the train in the illustration on this page. Under steam power the 140.9 miles between Englewood and Fort Wayne are scheduled to be covered in 123 min. in one direction, and 122 min. in the other, the respective average speeds being 68.7 and 69.3 m.p.h. There is too a 66.8 m.p.h. sprint over the 102.4 miles between Upper Sandusky and Fort Wayne in the Westbound direction only, so the streamlined "Pacifics" have no easy task.

The style of streamlining adopted for these locomotives is well shown by No. 3768 in the illustration above. The engines have the bulbous front and rounded "apron" now popular for steam streamliners in the United States, but there is rather more casing-in of the wheels and motion than is evident on certain other American streamlined engines. The headlamp is inset in the smoke-box front, and above it appears an emblem incorporating two outstretched wings—symbols of speed—with the monogram "*P.R.R.*," standing for "*Pennsylvania Railroad*," in the central panel. The treatment of the chimney too is interesting; the distinctive projecting rim of the chimney enclosure suggests speed and tones well with the angle of the casing below it at the front end, which slopes gradually upward to merge with it and blends into the cab roof.

The interior of the train affords literally all the comforts of a hotel and forms a triumph of design. The "*Broadway Limited*" is described by the Pennsylvania Railroad as an all-room Pullman train. There are no open sections in the sleeping cars run on this overnight service; instead five different types of private room accommodation are afforded. The dining and lounge cars are novel in arrangement, and are in keeping with the striking character of the remainder of the train. Finally at the rear end is the observation car, in which the open platform has given place to a glass-enclosed saloon.

The other members of the Pennsylvania fleet that have been re-equipped are "*The General*," also running between New York and Chicago, the "*Liberty Limited*," between Washington and Chicago, and the "*Spirit of St. Louis*," between New York and St. Louis.

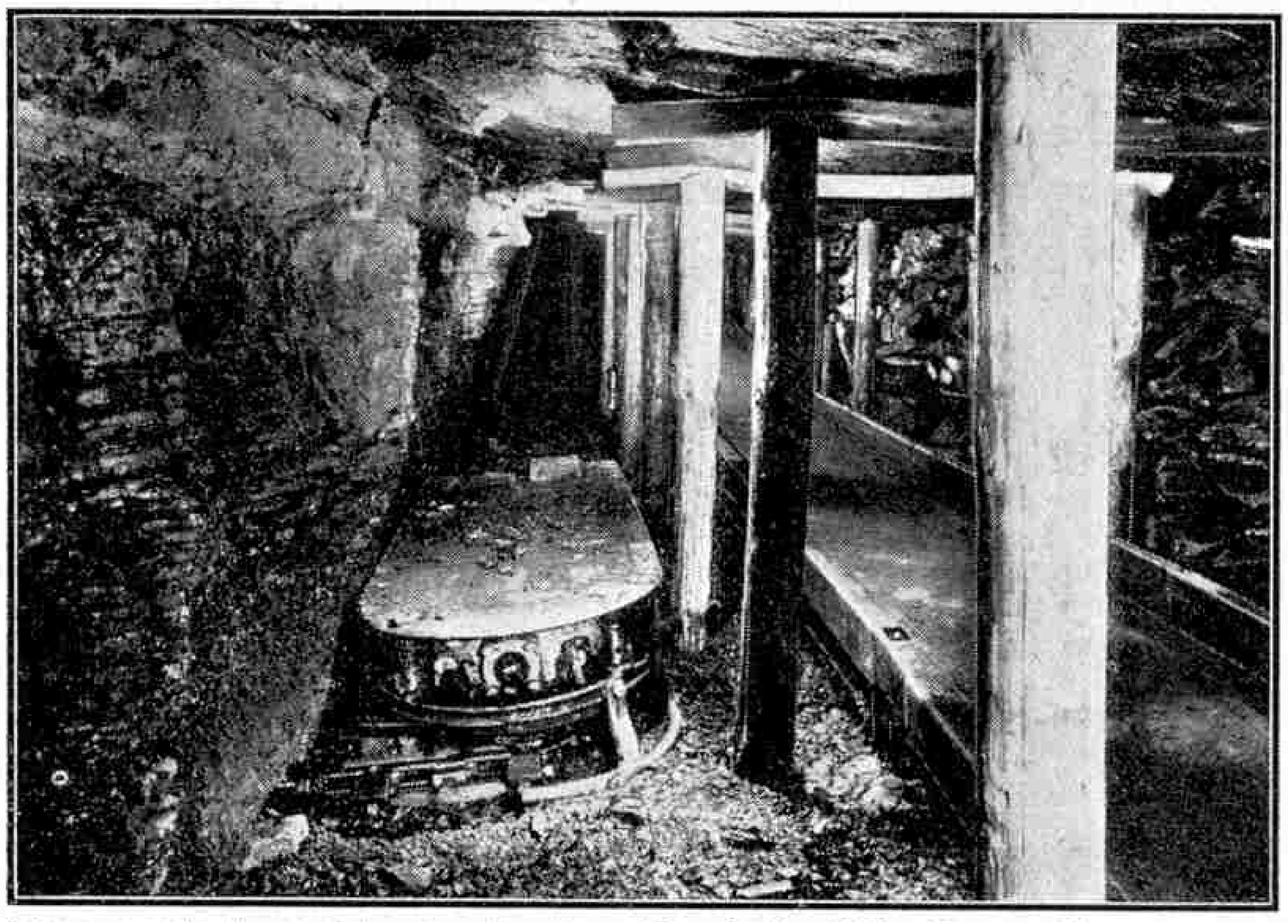
Coal-Mining in Britain

1.–Mechanisation in Modern Collieries

By a Mining Engineer

A GREAT deal of romance has been woven round coal and coal-mining. "Black Diamonds," "Buried Sunshine," and many other picturesque terms have been applied to this unromantic looking stuff, while the undoubted hazards faced by mine workers, and the wide publicity given to any mining accident, have tended to produce an unduly dramatic picture of what a coal mine is really like. A coal mine is not often considered as a highly organised factory, yet that in effect is what it is; a factory mechanised to a remarkably complete extent, and laid out for mass production of a particularly difficult kind. Coal must be cheap, or it will be driven off the market by rival forms of fuel; and so practically every operation, from drilling and cutting at the face until the coal leaves the colliery, sorted and washed, in railway trucks, is performed by special machinery.

In describing the working of a modern colliery I shall not refer to any one in particular; no two pits have identical lay-outs, and the equipment also varies in different parts of the country owing to wide variations in the physical nature of the coal mined. In every colliery the Pit Top and Pit Bottom function as quite separate units. They may be considered as two mass production factories at some distance from each other, linked only by the equivalent of a four track railway. There are at least two shafts, and in each of these when one cage is descending another cage is coming up, after the fashion of the cliff-lifts seen at many seaside resorts. The arrangement of the shafts is very important, quite apart from the question of pulling coal, for the shafts form an essential part of the ventilation system. Good ventilation is indeed the life blood of a coal mine, and so it will be well to begin with a brief description of the principles involved.



A Samson coal cutter at work undercutting the coal face. On the right is a Mavor and Coulson coal face belt conveyor. Photograph by courtesy of Mavor and Coulson Ltd., Glasgow.

Circulation of air is set up and maintained by means of a very powerful fan, usually of the extractor type. One of the two shafts is called the Downcast, and through this the ventilating air passes down to the underground workings. At the pit bottom the haulage ways and other roads leading to the coal face are intersected with cross galleries in such a manner that there is a steady stream of air throughout the whole layout. Carefully arranged airlocks ensure that no section of the workings shall be short-circuited, and the current is then drawn to the surface through the second of the two shafts, which is called the Upcast. At the surface the mouth of the upcast shaft is entirely cased in, so that the proper amount of suction can be obtained. All entries to the pit top, whether for men, materials, or coal wagons, are through airlocks. These are not absolutely airtight compartments, as are sometimes necessary in the construction of underground railways, but have about the same degree of airtightness as is afforded by a door in an ordinary dwelling house. It is enough to stop draught.

We will now return to the coal face, and follow through the processes involved in the winning of coal and its conveyance to the surface. Coal lies in the earth in layers, or seams as they are called, that may vary between 3 ft. and 10 ft. in vertical depth. In many places still wider extremes are met. The means of loosening and getting the coal out of the seam is still entirely by hand in a great number of collieries; in others the work is completely mechanised; while in perhaps the majority of pits in this country certain processes are done by machine and others by hand. But whether manual labour or machinery is used, the actual method of getting the coal out is the same in almost all cases. The first job is to undercut the section to be got out; this may be done by hand-picks, but nowadays mechanical coal cutters are coming more and more into favour. A typical apparatus for this job consists in the main of an oblong portion around the edge of which there travels, caterpillar fashion, a chain carrying a large number of cutters, each like the tool of an ordinary planing machine. The oblong is pivoted at one end, and can be swung round like the jib of a crane. This form of construction allows a very deep undercut to be made.

The next thing is to get the coal to fall away. This again is done by hand, with a pick, in many places, but considerations of output demand quicker methods. Blasting is used to a large extent, but one of the most interesting modern developments is to use a so-called "burster." For both methods it is necessary to drill a series of holes in which to place the explosive, or the burster. Nowadays these charge holes are often drilled as deep as 3 ft. 6 in. The undercut is even deeper, and as it may extend for some 12 ft. to 15 ft. of the face, the large amount of coal that falls at each firing can be readily imagined. Common black gunpowder or high explosive is used for blasting, but a considerable advantage is claimed for the coal burster in that its work is done without any violent shock and without any shaking of the roof.

The coal burster on insertion looks nothing more than a long cylinder of rather small diameter. Hydraulic pressure is built up inside by means of a hand pump, and this causes a series of nine or ten pistons to move outward at right angles to the axis of the main cylinder. These pistons are normally flush with the periphery. The burster is inserted in the coal face so that when the pistons emerge it is in the direction of the undercut, and the pressure breaks down the wall of coal. A great advantage of this method is that it takes place gradually, and there is no need for other workers at the coal face to withdraw during the operation, as is of course necessary where blasting is used.

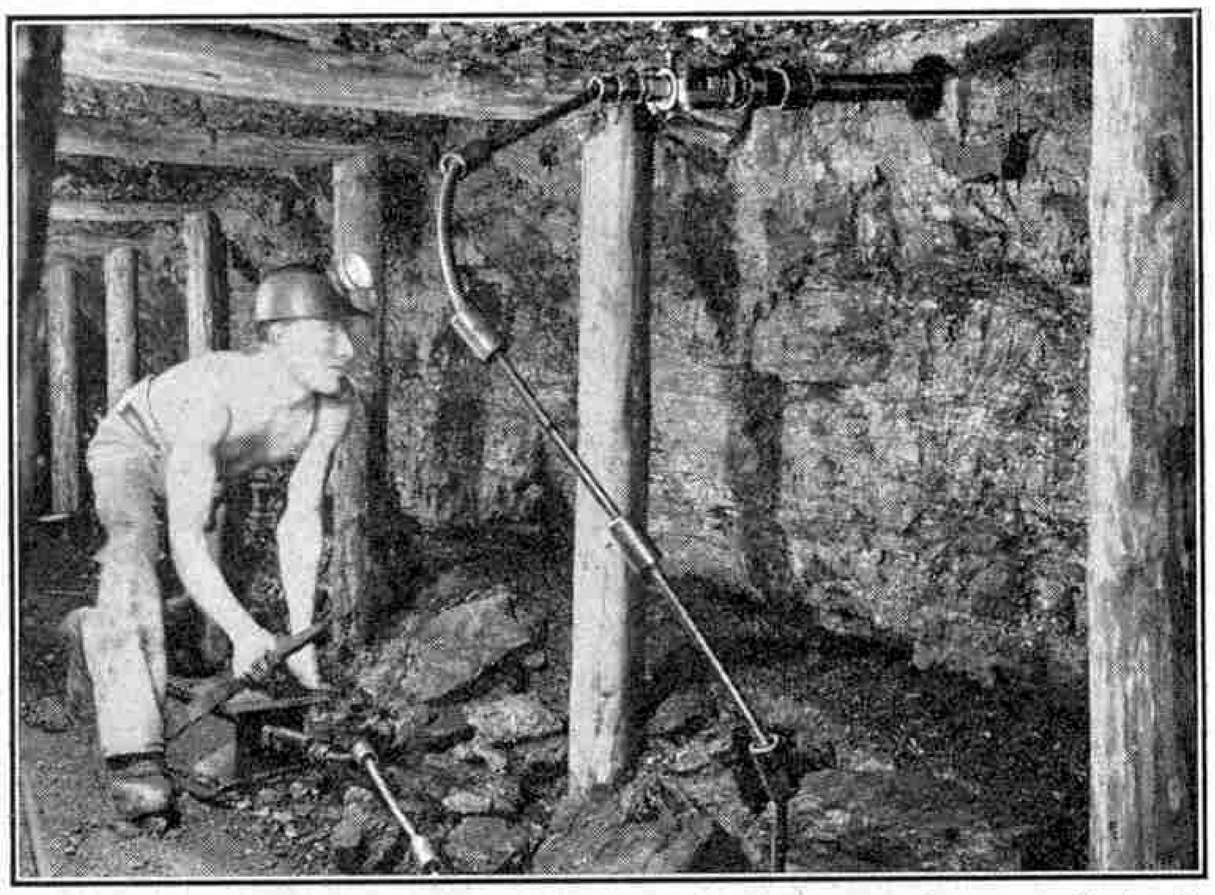
If the "fall" has taken place as a result of blasting it is advisable to wait a short time before setting about loading the coal for conveyance to the shaft, in order to allow any poisonous gases—the products of explosion—to be carried away by the ventilating air. Then the coal is placed either on a belt conveyor, or into small trucks known variously as tubs, trams, or corfs according to the locality of the mine. Loaded tubs from the various workings are hauled by ponies to some central collecting point, and there they are made up in trains of 20 or more for the run to the pit shaft. This may be half-a-mile or more, and endless rope haulage is often used. On the way to the shaft the construction of the underground "roadway" is worth noting. In many collieries the roof consists of a series of huge timber baulks, and the sides of the tunnel also are lined with timber; but nowadays increasing use is being made of steel as a roof support. For this special rolled sections are used, curved sometimes into a semi-circle; in some pits the shape of the tunnel is that of a Gothic arch.

The roadway, whatever its construction, is an eerie place. There is no light save an occasional wan pin-point from some man's safety lamp. One's own lamp reveals everywhere an incredible blackness—rails, props, and gear grimed with coal dust—and then very likely there comes the gaunt spectacle of roof arches and steel girders bent into fantastic shapes by the pressure of the earth above.

Before leaving the underground railways and coming to the

robot-looking machinery at the shaft-bottom I must not forget a word of praise for that splendid beast the colliery horse. Contrary to the popular conception of wretched animals living in conditions of squalor, no horses are better cared for. It is often thought too that most of them are blind; this is not so, although the eyesight of a small proportion does become defective after they have spent a number of years underground.

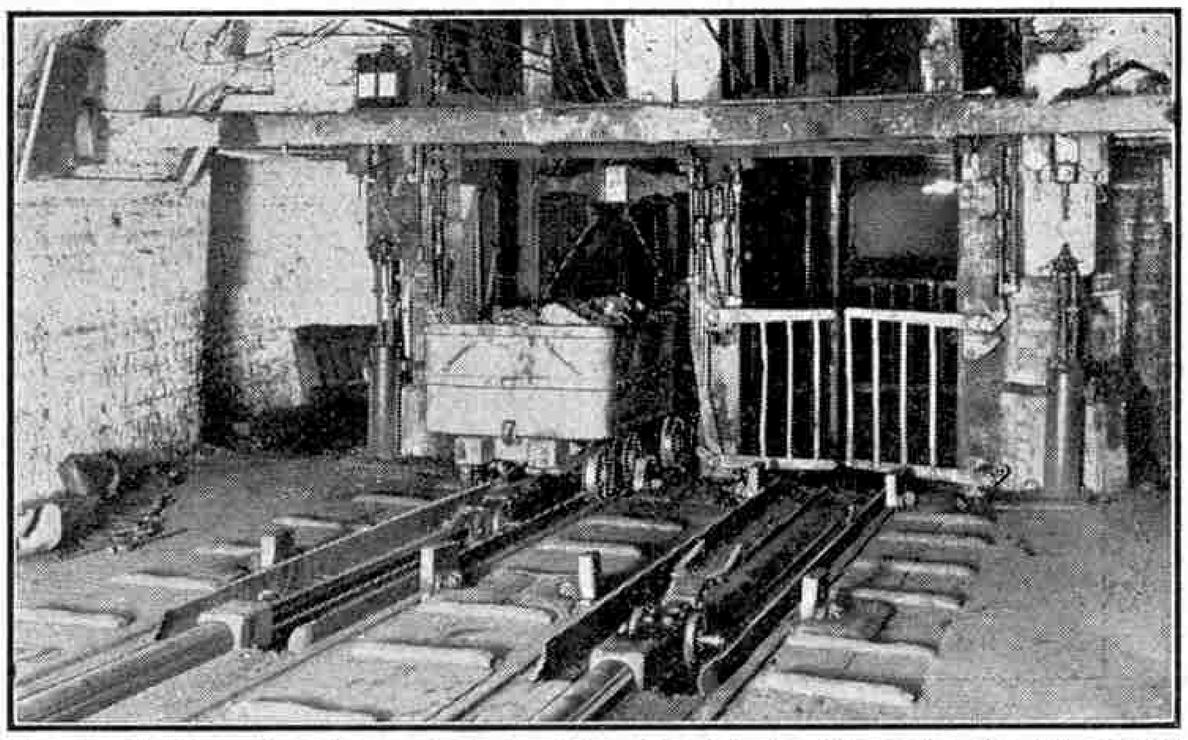
The first sign that one is nearing the shaft bottom is of a few lights ahead. The trains of tubs brought by the haulage rope come to a stand ready for marshalling on the approach roads to the cages. The atmosphere is a little more cheerful. The tunnel is brick lined, and may be whitewashed, but still there remains, quite near, the forbidding blackness of the roadway leading to the coal face. Loading the tubs into the cages is one of the most vital operations in the whole underground organisation of a colliery. When working at full pressure there is usually one wind every minute —some pits work considerably faster than this—and while one set of tubs are being loaded at the bottom, the other cage is being unloaded at the surface. One minute includes not only the time of loading, but also the winding time from top to bottom of the shaft! In a really deep pit, that is one over 2,000 ft., the cages attain speeds of 60 m.p.h. and more during ascent and descent, but even so the time available for loading is only a matter of seconds. The cage arrives at the shaft bottom carrying two empty tubs tandem-wise. Men are waiting, and the instant the rail track in the cage lines up with the track leading from the underground roadway, two loaded tubs are pushed into the cage, thus pushing out the two empty ones on the far side.



"Bursting" coal from the face after undercutting. The coal is broken up by means of hydraulic pressure. Photograph by courtesy of Gullick Ltd., Wigan.

This sounds simple enough, but even with a slight gradient to assist, the labour of starting two heavily laden tubs is considerable, and during a spell of six or seven hours winding at top speed the rate of loading varies quite an amount, as the men tend to get tired. For this reason the loading operation in many collieries has been mechanised by the installation of power operated pushers or rams. But the application of power to the "decking" of tubs, as it is called, necessitates the taking of quite elaborate safeguards. Several processes are involved, and the functioning of these has to be interlocked, like the signals and points of a railway station. The rams are usually operated by compressed air, but before they can be set in motion the alignment of the cage must be proved correct, in just the same way as the switch blades of railway points have to be detected and found correct before a signal can be lowered.

The ram is an immensely long cylinder, with a cross-head fixed to the piston; instead of the familiar connecting rod joined to the cross-head of a steam engine there is a forked arm that engages the axle of a tub. The cross-head is carried on a pair of wheels that run in a channel iron track between the tub rails, and when the air is put on, the piston of the ram is pushed rapidly out, thus carrying the tubs into the cage. The use of rams greatly simplifies decking at those pits where two, and even three-deck cages are used. Then anything up to nine tubs can be loaded simultaneously into one cage, and only one man is needed to control the whole operation. What can be done by extreme mechanisation is well illustrated by the average performance at a South Yorkshire colliery. The shaft is over 2,600 ft. deep, and during the winding periods they pull out roughly 300 tons of coal per hour!



The shaft bottom of a Northumberland colliery showing the gates and a full tub of coal being pushed into the cage by pneumatic rams.

The cages are nothing more than steel boxes, open at both ends, but they are equipped with catches fixed between the rails that prevent the tubs from running out until either the shaft top or the shaft bottom is reached. The entrance to the shaft, both underground and on the surface, is fenced by light iron gates. These, too, are often controlled by compressed air, and they open automatically directly a cage arrives and takes up a correct alignment. When a cage is properly loaded, the onsetter, or banksman, as he is variously called, signals the all-clear to the winding engine man by means of an electric plunger, and in a split second the cage is away on its flight to the surface.

British coal mines, taken on the whole, are not more than ordinarily deep. The deepest coal mines in the world are in Germany, where some shafts go down to over 3,500 ft. Even these depths are only moderate when compared to some of the most famous gold mines. On the Central Rand, near Johannesburg, there are mines 8,000 ft. and even more in depth.

At the pit top the same arrangement of loading rams is to be found, though there is an additional piece of apparatus —and a most important one too—that is not necessary at the pit bottom. While a cage is being unloaded at the pit top, and the empty tubs are being rammed in ready to be taken underground, the cage is supported not on the winding rope but on four catches that are pivoted on the pit-head structure. When a cage arrives at the top it is hauled a few inches higher than the decking level. The onsetter, by means of a lever, or compressed-air gear, moves these catches, or "keps" as they are usually called, out under the cage, and the cage is lowered gently on to them. The controls are so interlocked that no loading or unloading can take place until the keps are under the cage. In a similar manner the onsetter cannot give the "right-away" to the engineman to begin winding until the keps have been removed again and the way is clear for the cage to drop.

At the downcast shaft, the mouth of which is not encased, the loaded tubs are run straight to the weighbridge; but in the case of the upcast shaft further control and interlocking is necessary to pass the tubs through the airlock. The two doors, entrance and exit, must never be open at the same time, otherwise there would be a very good imitation of a whirlwind through the airlock. A set of three or four loaded tubs are therefore pushed from the pit mouth, stopped inside the airlock, and the entrance door closed behind them. Then the exit door is opened and the tubs are allowed to pass on. In many collieries this operation is controlled by automatic gear, and an example of the interlocking necessary is seen in the stopping device inside the airlock. This remains in the raised or "stop" position so long as the exit door is closed, and directly this door opens the stop lowers automatically to permit the passage of a set of tubs.

Once clear of the air-lock the tubs run on to the weighbridge. But nowadays the coal undergoes a considerable amount of further treatment before it is ready for the user. When it reaches the pit top it is of all shapes and sizes, just as it is gathered after a "fall," and also contains a proportion of dirt and rubbish. It cannot be put on the market in this condition, and therefore has to be washed, de-dusted, and screened to sort it into the different sizes of lump. An account of the ingenious plant used for these purposes will be given in the next issue of the *"M.M."*

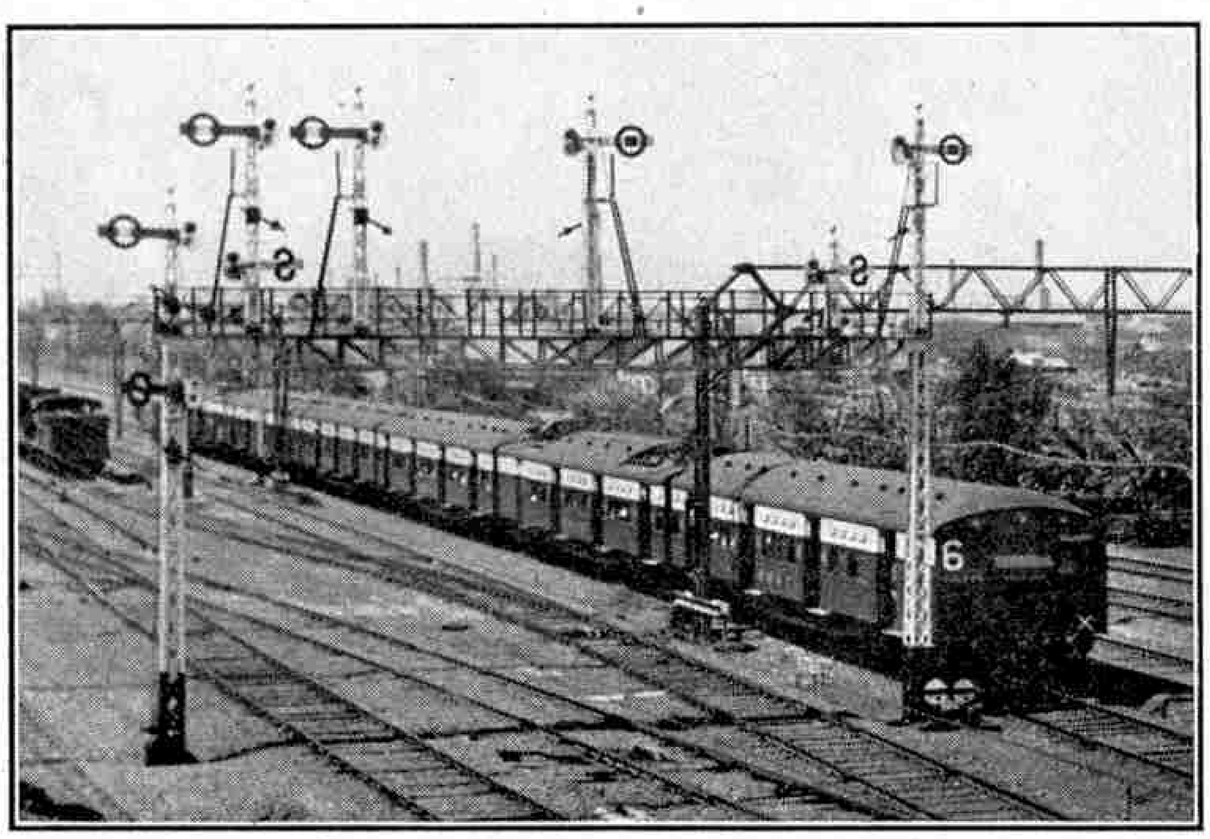
Railway Signalling Past and Present

How the Modern System has Developed

By a Railway Signal Engineer

THE safety of rail travel depends largely on the signalling system adopted to control the traffic. As traffic has increased, as trains have become faster, so has the science of signalling advanced to maintain and even improve the safety of travel. The story of the development of signalling is in fact the development of railways. Tradition explains that the first type of railway signal ever used was a lighted candle placed in the window of a stationmaster's house on the Stockton and Darlington Railway. If the light was not exhibited the drivers knew that they were not required to stop.

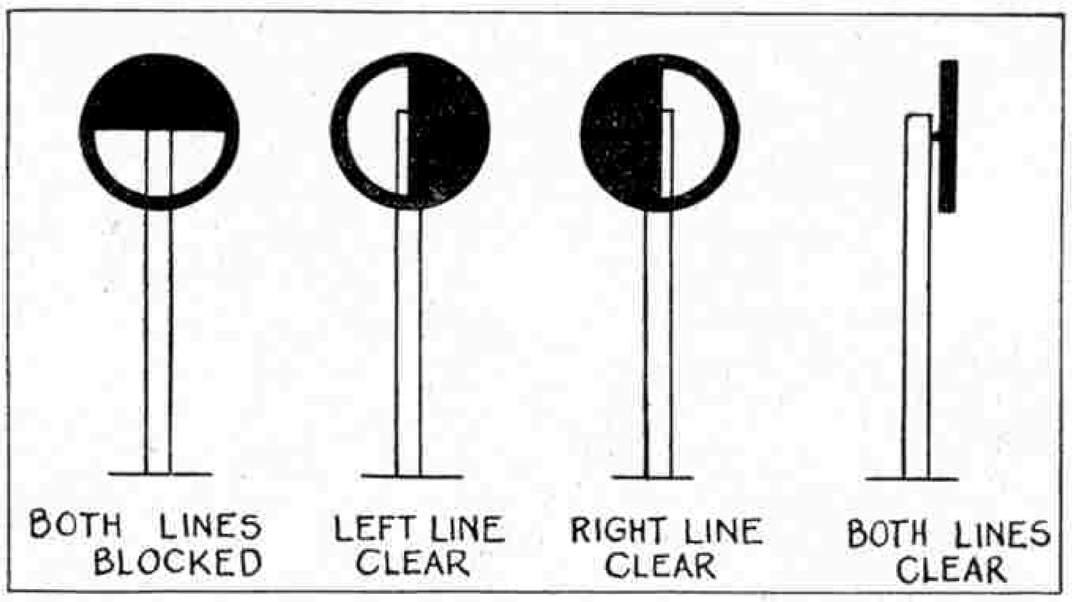
In the early days of railways the timetables were so arranged that trains could not overtake each other. Junctions and crossings were few, and where these existed trains either waited their turn or came to a standstill on reaching the junction. With the development of traffic, these methods were found to be inadequate and "policemen" were stationed at certain places where it might be necessary to stop a train. The line was considered to be normally clear and the drivers assumed such to be the case if the policemen were not visible.



A typical example, in India, of a mechanically-operated gantry fitted with lower quadrant semaphore signals. The rings on the large semaphores show that they apply to local traffic.

In due course this arrangement was found impracticable and the first type of railway signals were manufactured, very primitive affairs compared to those in use today. In the early days on the G.W.R. the ball and the kite signals were introduced. A signal of the former type is shown in the left-hand lower illustration on the next page. The ball was hauled to the top of the post to indicate safety. At night an ordinary lantern was used. The kite signal consisted of a canvas screen, at the top of a post, which was spread out like a curtain to show "danger." With the canvas half-spread a "caution" position was obtained, while the safety or "clear" aspect was displayed with the canvas entirely reefed or drawn to one end of its supporting frame.

Among other types of signals employed about the same time were the red board and the disc-and-crossbar. The red board was found objectionable because the "clear" signal was dependent on its absence, so that if the board had been destroyed from any cause a false "clear" signal would have been given. This led to the adoption of a separate positive indication for "clear," and an attempt was made to provide this in the disc-and-crossbar signal. In this a disc and a crossbar were mounted at right angles to one another on a post that could be rotated. "Line clear" was indicated when the disc was facing the driver, the crossbar being then end-on or parallel to the track. Danger was indicated by turning the signal so that the crossbar faced the train, the disc then being edge-on to the driver.



This diagram shows four different aspects of the disc signal once employed on the former L.S.W.R. for controlling traffic on parallel tracks.

Many other types of signals came into use, widely different in design but all working on the same general principle. An interesting one was the signal for both lines used by the London and South Western Railway for some time. The lower illustration on this page shows how it worked.

The semaphore type of signal so familiar to-day was introduced in the year 1842. Until 1870 this was worked as a three-position signal, having an intermediate or "caution" aspect in addition to the "danger" and "line clear" aspects that are still used. The semaphore was pivoted in a slot in the post, and "danger" was indicated as it is now; the "caution" position was the present "line clear" of a lower-quadrant semaphore, and "line clear" was indicated by the disappearance of the arm into the slot in the post. Semaphore signals were for long invariably of the lower-quadrant type. Their replacement by upper-quadrant signals did not begin until comparatively recent times.

It may surprise some readers to learn that light signals were in use on railways as long as 30 years ago. Owing to the short range of the early signals of this type their usefulness was restricted to tunnels and places where the semaphore arm could not be used. Experiments with long-range colour light signals were made in England as early as 1913. Although these were successful, no extensive installation was carried out until 1921, when over 50

two-aspect colour light signals were installed on the Liverpool Overhead Railway.

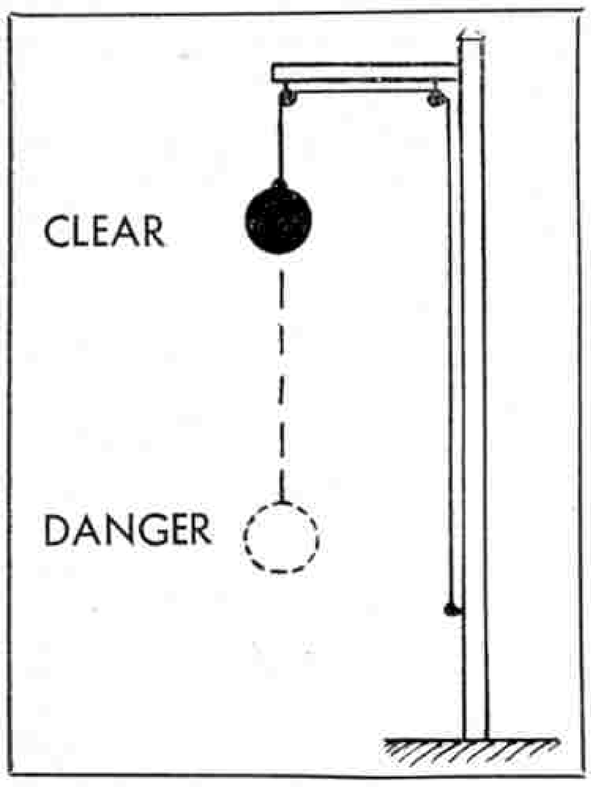
This type of signal has since undergone constant development, and to-day thousands are in use all over the world. Improvements to lamps and lenses have brought them to a very high state of efficiency. The intensity of the light beam is from 6,000 to 7,000 candle-power, which means that very often no special signals are required in case of fog, and their use means that drivers see the same indication by day and night.

The first levers operating signals and points were placed at the junctions themselves. When the lever lay to the right the points were set for a train to go in that direction; when the lever lay to the left, the points were set to the left. To assist the driver in picking out the lever it was painted red.

When the points were operated from a position some distance away the idea of indicating their position was retained by using an additional indicator lever working with the point switches. Subsequently the design was improved to operate coloured glasses, which were illuminated at night. White was used for the main line, green for the turnout and red for "points incorrectly set."

As traffic increased it was necessary to group the levers working signals and points at one place. The first interlocking frame was designed in 1856 by Mr. Saxby and installed at Bricklayers Arms Junction. The levers were interlocked with each other so that those controlling conflicting movements could not be pulled at the same time. The adoption of interlocking for all railways in Great Britain was made compulsory in 1889.

The original arrangement for keeping trains apart on the same line was based on the time-interval principle, a certain period of time being allowed to elapse after the passage of a train before a second was allowed to proceed. A common arrangement at a station was to have two signal discs, one above the other. The top disc was turned round as soon as a train passed, and then showed red to a following train. At the end of five minutes this board was turned edgeways, and the lower one, painted green, was turned round to indicate that a following train might proceed with caution.



The ball signal used on the G.W.R. in 1838, showing "danger" and "clear" indications.

Nowadays an interval of space separates successive trains on the same line, and for this purpose it is necessary to divide the line into short sections varying in length in proportion to the traffic, the point of division being indicated by the provision of a signal cabin controlling the signals. To signal trains over these sections some form of telegraphic or other communication between signal cabins is necessary.

Part of a modern colour-light signal installation. The signals shown are of the three-aspect pattern.

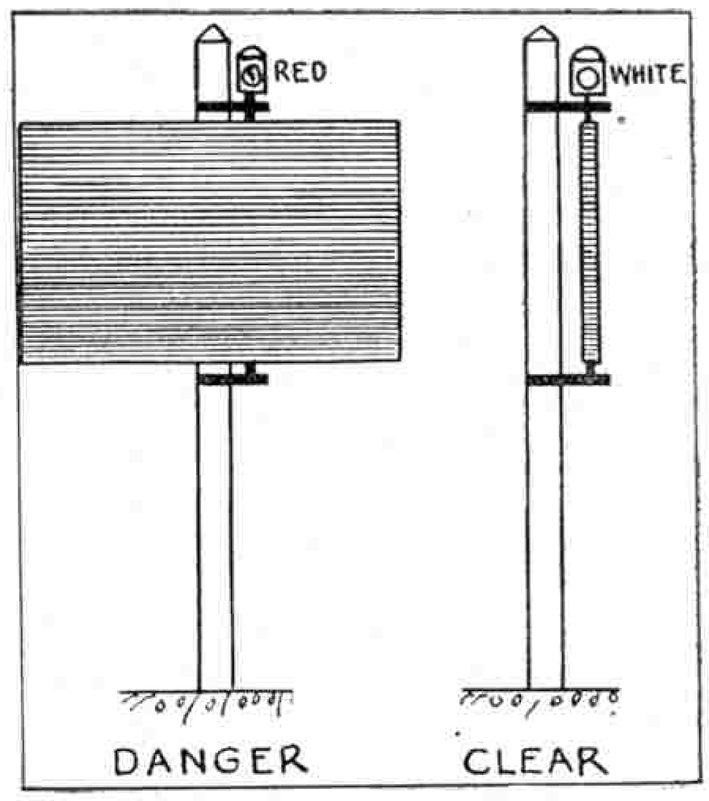
The first actual working telegraph of any length was the Cook and Wheatstone installation between Paddington and West Drayton on the G.W.R., which was opened in 1838.

The use of the electric telegraph made it possible to ascertain that a train had actually reached the station ahead before a second train was allowed to proceed on the same line. The usual arrangement with this early system was to have a signal box between each block section, with telegraphic communication between the boxes. Then followed the introduction of the needle block instrument and of other types of electric instruments of improved pattern. In later years, a system known as "Lock and Block" was brought out. This made use of an arrangement of electric instruments and electric lever locks, which prevented a signalman from "clearing" a signal leading into a block section until he had received permission, indicated by "line clear" on the block instrument, from the next signal cabin ahead.

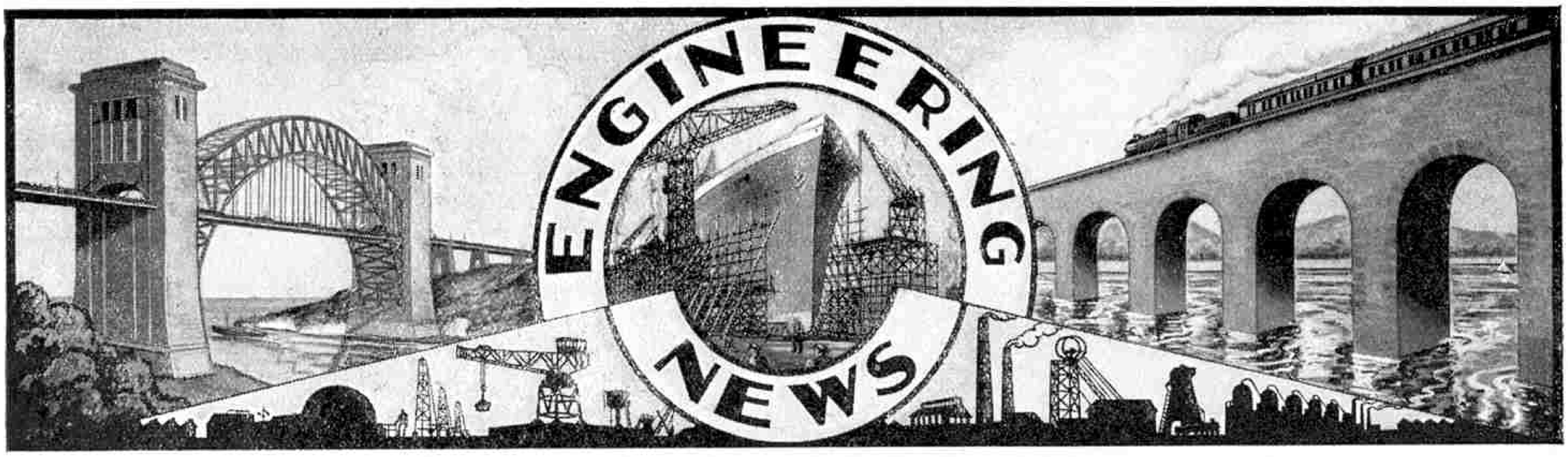
On sections of railway where there is a very heavy service a system known as track circuiting is used. The track circuit is the backbone of modern signalling. It consists of an arrangement whereby the running rails are used as part of an electrical circuit, and signals applying over one section cannot be "cleared" until the train has passed into the next section. In track-circuited areas the position of trains is indicated to the signalman by an illuminated diagram of the lines under his control, on which the positions of all signals, points and track circuits are shown. Where the trains themselves are is shown by lights.

In the latter part of the nineteenth century railways in America started to use electricity and compressed air to operate their signals and points. The first power frame for operating this apparatus was designed by George Westinghouse and installed at Bound Brook on the Philadelphia and Reading Railroad in 1884. The former Great Eastern Railway claimed the first power frame to be used in this country and this was installed at Bishopsgate in 1899.

A recent development in power lever frame design has been to abolish mechanical interlocking between levers and use electric locks only. In some layouts the lever has been abolished altogether. Control is by switches mounted on the signal diagram. A notable example is that at Leeds described in the June 1937 *"M.M."*



The two aspects of the old-type red board signal are shown in this diagram.



Cars Driven by Gas

Motor vehicles driven by gas made from coal or wood are becoming increasingly popular in France. Some of these use coal gas stored in iron bottles under pressure, but others actually make their own gas from timber, coke or coal as they run.

In the compressed gas system the storage cylinders usually hold sufficient fuel for a run of about 100 miles. A reducing valve brings down the pressure of the gas to nearly that of the atmosphere before it enters the mixer, which serves as a carburetter. Petrol also is carried, and the driver can switch over from one fuel to the other without having to stop the engine.

Motor vehicles making their own gas carry a miniature furnace, into which ordinary wood, coke, coal, charcoal or pure anthracite can be fed. The driver fills the hopper of the furnace before starting. A standard generator using anthracite will give enough gas for a run of about 125 miles at one filling, but even wood splinters will produce enough gas for a run of about 100 miles.

Gear Wheels Made From Silk

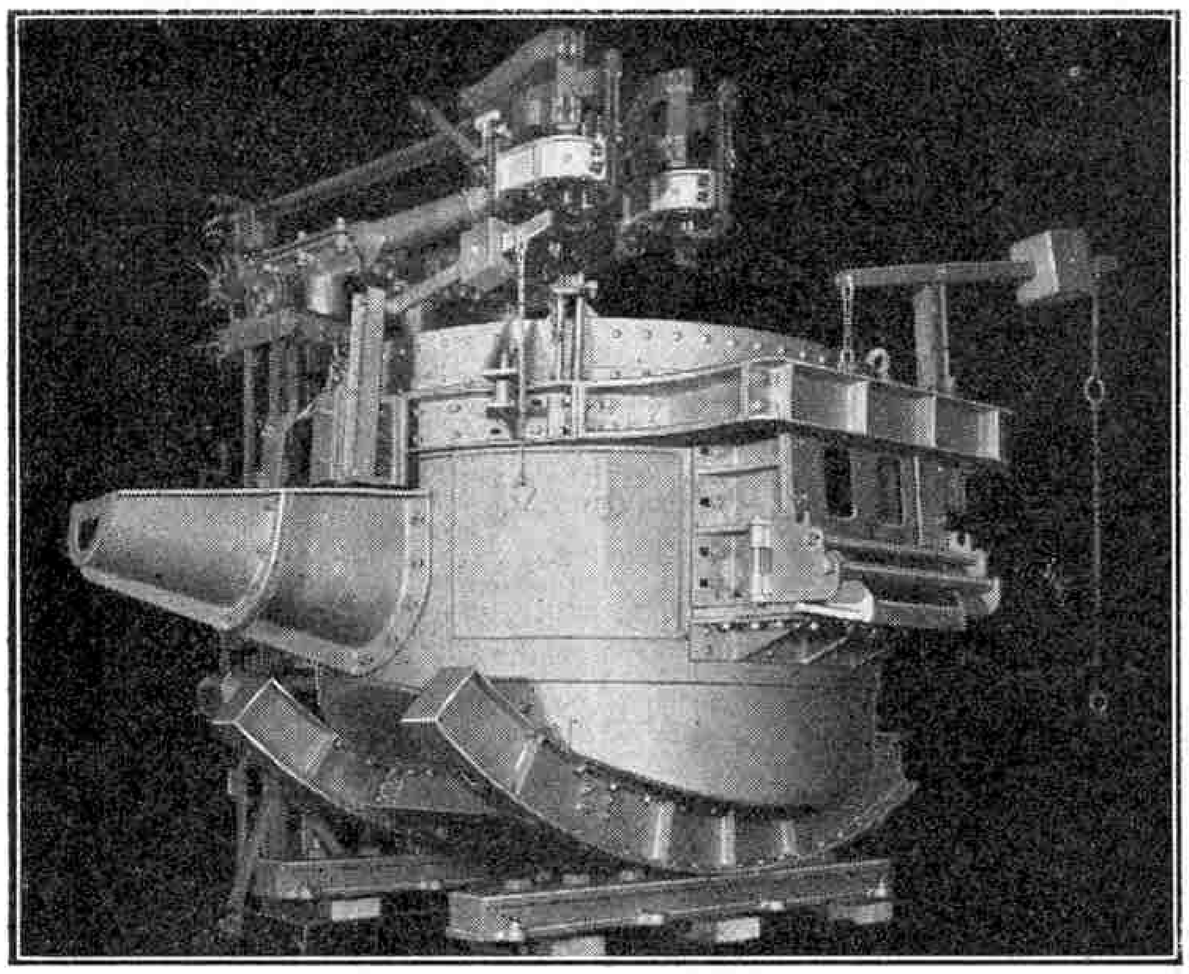
Noiseless cog-wheels made of silk are being used in Japan, and are claimed to be superior in efficiency to those made of metal or synthetic resins. They are very light in weight and do not warp, and the minutely fibrous nature of the contact surfaces ensures silent operation. Though the wheels will not resist the action of alkalis, they are very resistant to acids and the effects of high temperatures, and they are also oilproof.

The New Waterloo Bridge

The 30,000 tons of concrete that is being used in the construction of the new Waterloo Bridge over the Thames is being reinforced with 6,000 tons of small steel bars welded together. Spot welds will be made at the many points where the smaller bars cross the larger ones. When the bridge is completed in 1940 its weight will be borne by walls, within the piers, no more than 2 ft. 3 in. thick and 83 ft. long. These walls will be enclosed by hollow shells of reinforced concrete, 14 ft. wide and 106 ft. long, which will form the bases of the piers. They will be faced with granite prepared from the stones of the old bridge, and only one of them has so far been completed.

A Large Electric Furnace

The furnace shown in the accompanying illustration is an electric one of 3½ tons capacity that has been built by the machinery department of Edgar Allen and Co. Ltd., Sheffield, for the Electric Furnace Co. Ltd., London. The furnace will melt a full charge of metal in about 2½ hrs. It is for use overseas, and will be employed in making steel castings as well as ingots. It is supplied with current through a 1,200 kVA transformer provided with several low tension voltages, the desired voltage tapping being selected by means of a tap change switch operated by an electric motor.



An electric furnace in which three and a half tons of metal can be melted at one charge. Photograph by courtesy of Edgar Allen and Co. Ltd., Sheffield.

Speed Warning Device

A novel speed warning device for reminding drivers of motor vehicles when they have exceeded the speed limit has recently been introduced. It is described as a "touch warner," and it gives its warning by imparting an audible but soft and distinct tap to the rim of the steering wheel. The mechanism consists of a small rubber-buffered electro-magnet fitted below one of the spokes of the wheel, and operates through a simple type of governor situated in a convenient place in the speed recording system. When the device is in action a series of gentle taps are felt on the steering wheel whenever the car exceeds 30 m.p.h.

Safeguarding the Mississippi River

Great mattresses of asphalt are being laid on the banks of the Mississippi River to prevent erosion. The bank to be protected is first trimmed to a slope of from 1 in 3 to 1 in 5 by means of a bottomless scraper bucket. A complete asphalt plant is mounted on a large barge held parallel with the bank by mooring cables, and on it sand and fine earth are fed from storage bins to a mixing mill, into which hot asphalt is pumped. The mixture is then poured upon a steel netting mattress by machines somewhat like travelling cranes, which run to and fro along the deck of the barge. These machines not only spread the asphalt mixture, but also tamp or ram it by means of mechanically-operated bars. The asphalted netting is then paid out from the shore side of the barge and is hauled up the bank to a position near the top of the slope, where it is let into a deep groove to prevent it from being undermined by rain.

Gold Dredging in New Zealand

A new gold dredger that is said to be the largest in the world has begun work at Lake Kanieri, Westland, New Zealand. It weighs more than 3,000 tons, and has 160 digger buckets, each of 18 cu. ft. capacity. A second dredger of a similar type and size will also be employed at the lake. These two dredgers have been constructed as part of the New Zealand Government scheme to revive the gold-mining industry in the Dominion. If they prove successful eight similar dredgers will be built to work gold in various New Zealand rivers that hitherto has been inaccessible.

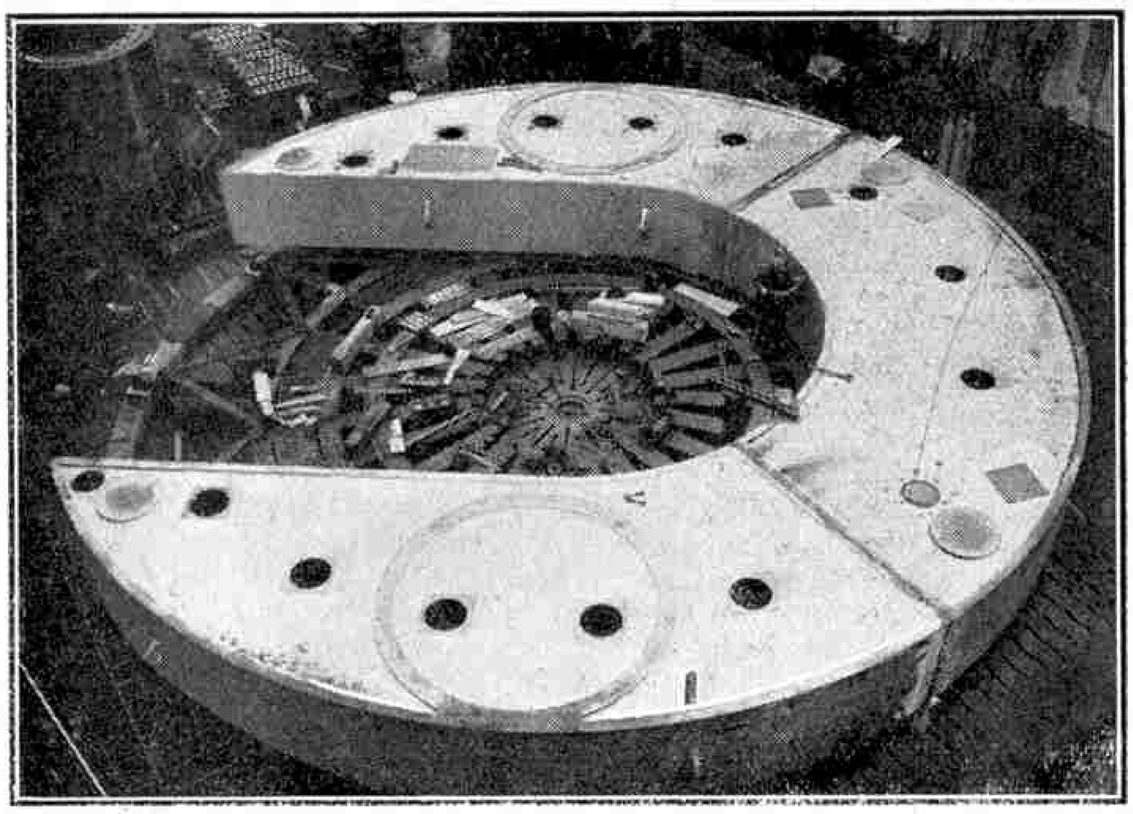
The Deepest Oil Well

What is claimed to be the deepest oil well in the world has recently been completed in the San Joaquin Valley, California. It is just over 15,000 ft. deep, and was drilled in 284 days. Considering its enormous depth the well is unusually straight, for tests have shown that at a depth of 11,570 ft. the hole is only 21 ft. away from the vertical line. The drill pipe used in boring the well was 3½ in. in diameter and weighed 15½ lb. per foot. The total weight of pipe in the shaft when the greatest depth was reached was over 126 tons!

Machining the World's Largest Bearing

The upper illustration on this page shows the giant horseshoe shaped bearing that will carry the weight of the world's largest telescope, now being built for installation on Mt. Palomar, California. It measures 46 ft. across and is over 4 ft. in thickness, and in form is a disc with a large U-shaped section cut out of it. In the illustration the bearing is shown in position for machining on a specially adapted boring mill at the East Pittsburgh works of the makers, the Westinghouse Electric and Manufacturing Co.

When in position at the telescope site, the bearing will rest on two steel oil pads through which oil will be pumped at a pressure of 250 lb. per sq. in. Although the telescope and its supporting structure will have the proportions of a six-storey building, friction between the bearing and the oil pads will be so slight that an electric motor of only about one-sixth horsepower could turn it. The friction will be 600 times less than that of a conventional type bearing.



The horseshoe bearing for the giant 200-in. telescope now being built in the United States. It weighs over 133 tons, and is the largest ever made. Photograph by courtesy of the Westinghouse Electric and Manufacturing Co.

Progress of the Dartford-Purfleet Tunnel

The construction of the new road tunnel under the Thames between Dartford and Purfleet is now well advanced. The first stage of the work consisted of boring the pilot tunnel, which was started simultaneously from shafts sunk on each side of the river. This bore has now been completed. It is 12 ft. in diameter, and has been driven at a depth of about 25 ft. below the bed of the river.

About 250,000 tons of earth will have to be excavated to form the main tunnel, which will have a diameter of 35 ft.; and most of this will be used for raising the level of the approach roads and for making embankments and flood banks. The distance between the two shafts is about 1,000 yds., and it is expected that the length of the tunnel from portal to portal will be about one mile.

World's Largest Transportable Transformer

A giant transportable emergency transformer has been completed by the Allgemeine Elektrizitäts Gesellschaft, Germany. It has a capacity of 120,000 kVA, which is large enough to allow the transformer to be used temporarily to replace any complete sub-station in Germany, should this be rendered necessary owing to breakdown or other causes.

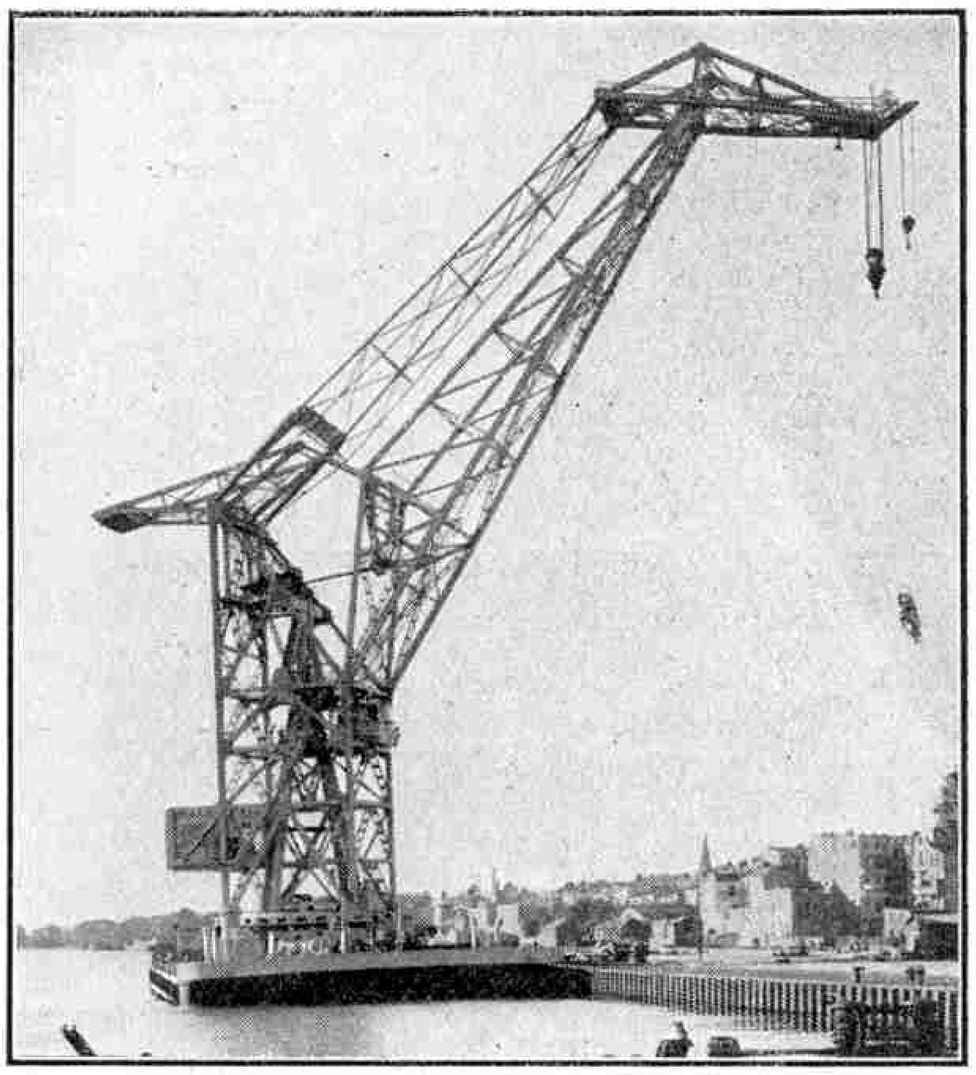
The transformer has three windings, operating at normal pressures of 220,000, 100,000 and 10,000 volts respectively. The windings are cooled by oil circulated through a tubular radiator, which is built on to the top of the case and in turn is cooled by forced air circulation set up by a fan.

The complete transformer is set in a heavy cradle mounted on three railway bogies, so that it can be moved from place to place. When it arrives at the site where it is to be used, it is only necessary to remove the protective casing and to connect the terminals to the cables to be fed.

Factory Control by Telewriter

A system of issuing written orders simultaneously at many different points has been installed at the great Ford motor factory at Dagenham. The apparatus consists of a telewriter transmitting set situated in the frame assembly department, and receiving stations installed at various points in the factory, such as the wheel and tyre assembly, the body department, the main assembly, and the building superintendent's office.

The transmitter is in the charge of the official responsible for planning the production, who issues written orders. What the telewriter does, in effect, is to operate several different mechanical pens at points widely separated. The original message is written with a lead pencil on writing paper, and is reproduced at each receiving station on a strip of paper that gradually unrolls as a mechanically controlled pen traces the words, reproducing the original handwriting exactly.



The jib of this novel 100-ton crane in the Naval Dockyard at Wilhelmshaven, Germany, is almost perfectly balanced at all angles. Photograph by courtesy of Demag Aktiengesellschaft, Duisburg, Germany.

Cotton Used in Road-making

Cotton fabric is being used to reinforce a new roadway that is being built near St. Joseph, Florida. The fabric is laid on the road foundation and tacked down at the edges to prevent wrinkling. It is then sprayed with hot asphalt, which seals the cotton to the foundation of the road. Crushed stone is sprayed on the fabric and rolled until a smooth surface is produced. By reinforcing roadways with cotton in this manner it is said that potholes are eliminated.

A Monster Motor Lorry

A giant lorry now in use at Los Angeles, California, holds 43 cu. yds. of material at one load, and the total weight of lorry and load is then about 100 tons. The lorry alone weighs about 36 tons. It has a 180-h.p. engine, and the driver has to control nine speeds forward and three in reverse. The highest speed of this giant when fully loaded is 15 m.p.h., and it can travel at 25 m.p.h. when empty. The lorry is employed in carrying spoil in connection with a flood control scheme.

An Engine Driven by Liquid Air

Liquid air can be used for driving engines for it vaporises rapidly, just as water does in modern boilers. A Japanese inventor has designed a unit making use of liquid air at a temperature of more than 200 deg. F. below zero. In this unit there is the engine itself, a container for the liquid air, a vaporiser and a liquifier. A pump is used to compress the air for liquifying it after passing through the engine, and the entire unit is enclosed, only sufficient liquid air being added from time to time to make up for loss due to leakage A 27-ft. boat fitted with this engine is said to have travelled at a speed of nearly 5 knots.

Floating Crane and Fire-Engine in One

A giant Demag floating crane of novel construction that is at work in the Naval Dockyard at Wilhelmshaven, Germany, is shown in the lower illustration on this page. The crane is fitted with a special type of double-guide level-luffing jib, the design of which ensures that the jib is almost perfectly balanced at all angles. Three hoisting hooks are provided, two of which are capable of lifting loads up to 50 tons, while a third can handle loads up to 10 tons. When necessary the two 50-ton hooks can be used in conjunction so that loads up to 100 tons can be lifted.

The pontoon on which the crane is mounted is 131 ft. in length and 75 ft. wide. It contains its own propelling machinery, comprising two seven-cylinder 450 h.p. Diesel engines that drive two of the novel Voith-Schneider propellers described on page 369 of the July 1938 *"M.M."* The engines also drive generators that supply current for the crane motors and deck winches

The crane also is a floating fire-engine, for the engine and pumps provided for dealing with the bilges can be used for pumping water through a pipe to a spray nozzle at the jib head.

OF GENERAL INTEREST

How we Know that the Earth Turns Round

The lower photograph on this page shows an interesting experiment that always impresses visitors to museums and scientific exhibitions where it is shown. Every morning, at the hour marked on the clock placed alongside, the great pendulum shown in the illustration is released by burning through the thread holding it to one side, and is allowed to swing backward and forward over a line marked on the floor. Very soon it deviates from the line, and as the day goes on its course seems to turn farther and arther away from that on which it started. ctually the pendulum continues to swing the same line throughout, and it is the Earth beneath it that is turning, carrying the line with it. The pendulum is set free by burning the thread instead of cutting it, or merely giving the bob a push, to make sure that it will swing freely.

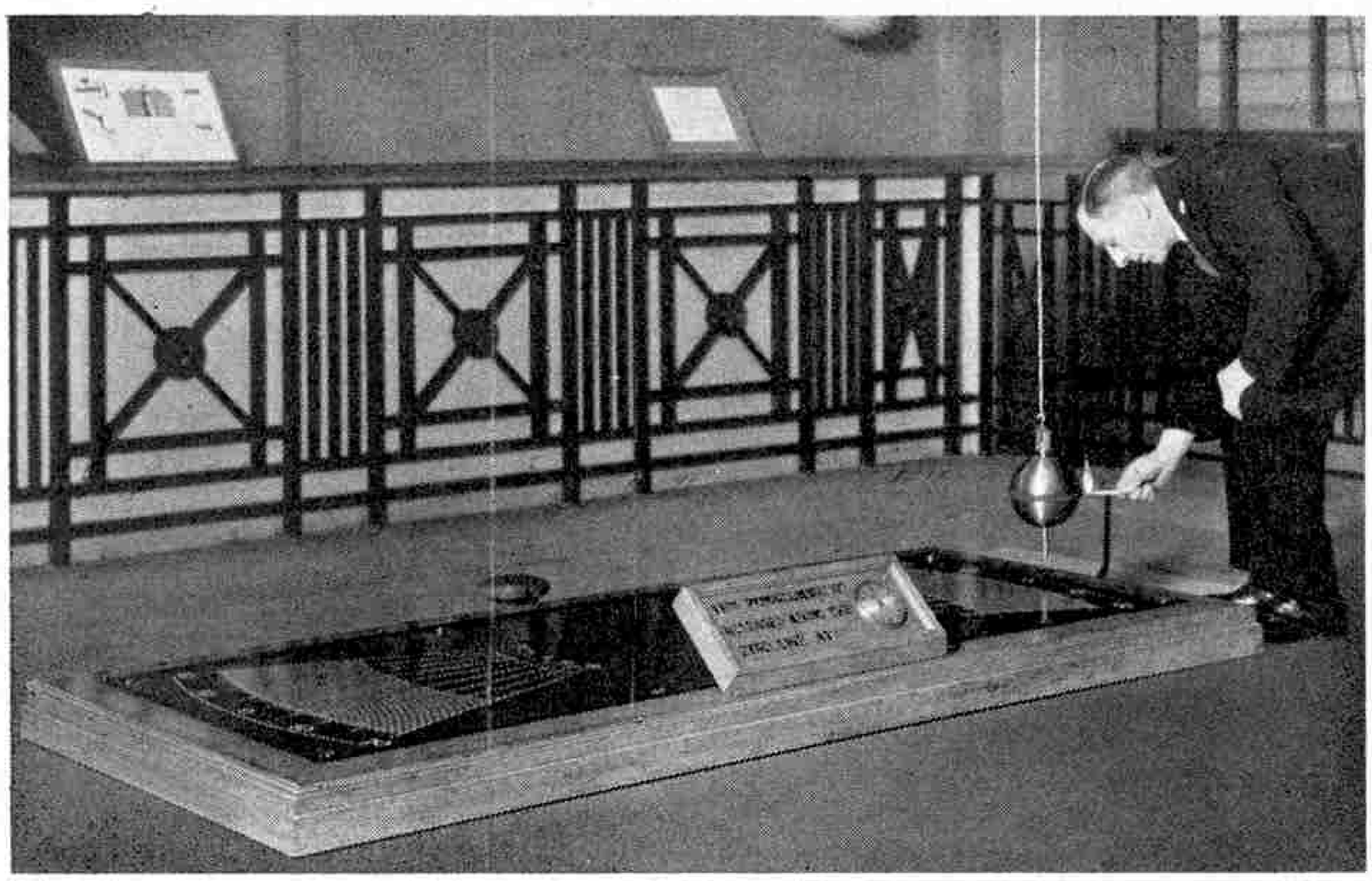
This interesting experiment was first made by Foucault, a Frenchman who nearly 100 years ago hung a pendulum from the dome of the Pantheon, in Paris. Since then many other pendulums of this kind have been installed. The one illustrated is in the Science Museum, South Kensington, London, and there is another in Edinburgh. A very interesting Foucault pendulum was installed in the Franklin Institute, Philadelphia, four years ago. Its bob is a gigantic sphere weighing almost a ton, and is supported by a wire 85 ft. in length. Taking the wire to the Institute was an imposing parade, for it was carried by 11 men strung out at intervals along its length and was given a mounted police escort in order to avoid interference from traffic! The men were not needed merely to carry the wire, for it weighs only about 9 lb.; they were there to keep it taut and prevent it from developing kinks.

A Fairground Experiment

To see what really happens to such a pendulum one could imagine it hung at the centre of a merry-go-round and set swinging in one direction. It would keep moving in this direction when the cars or horses of the merry-go-round careered round it, and to anyone travelling with these the pendulum itself would seem to turn. Similarly it appears to move to those who travel round with the Earth, but the movement is slower and takes longer to detect.

How far a Foucault pendulum seems to deviate from the direction in which it starts depends on where it is swung. If it were suspended from a point directly above the North Pole, and started swinging in line with some fixed star, it would continue to do so while the Earth turned, and its line of swing would appear to make a complete revolution in 24 hours. The direction of turn would be clockwise, looking down from the point of suspension, and a similar pendulum at the South Pole would appear to turn in the opposite direction. At the Equator there would be no turn at all, and at points in between the amount of turn would depend upon the proportionate distance from one or other of the Poles.

The turning of the Earth in space has other curious effects. For instance, a stone dropped down a mineshaft anywhere except at the Poles would fall slightly to the east. The difference would not be very great, and could only be detected by very careful measurement. The reason for it is that the stone would begin with the eastward speed given it by the turning of the Earth, which it would retain throughout its drop. The ground at the foot of the shaft has a lower speed eastward than the stone, because it is nearer the Earth's centre, and so the stone would get slightly ahead.



Starting the swing of the Foucault pendulum at Science Museum by burning through a thread holding the bob. The apparent deviation of the pendulum from its original line of swing shows that the Earth is rotating. Photograph by courtesy of the Director of the Science Museum, South Kensington, London.

The Five-Mile Gundagai

The monument seen in one of the illustrations on this page, showing a dog on a "tucker" box, stands at Gundagai, in New South Wales. This monument is the gift of the citizens of Gundagai, and is a tribute to the pioneers of Australia. The spot on which it stands was the famous camping ground of the "bullockies,"

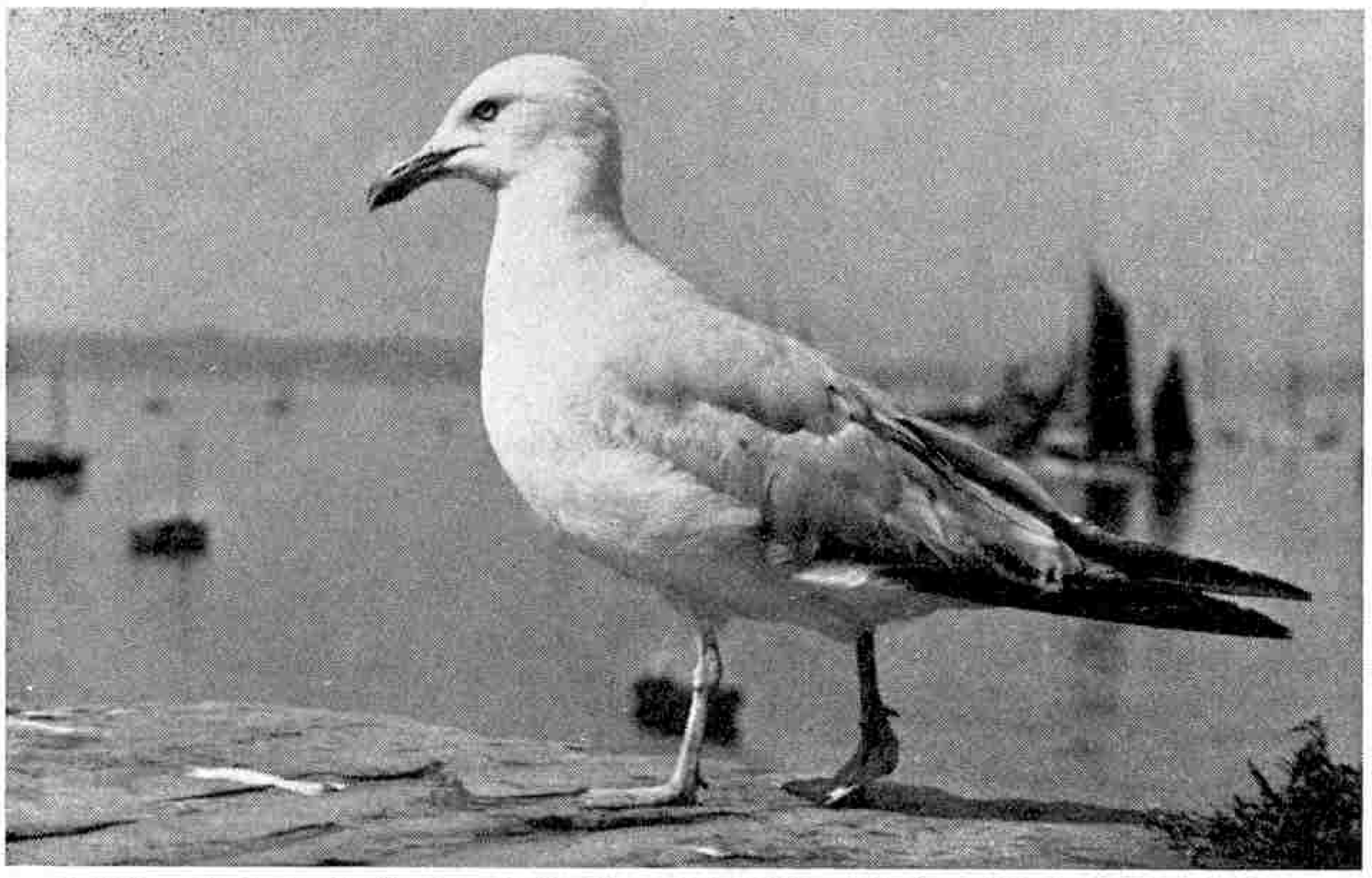
The "Pioneer's Monument" at Gundagai, New South Wales, the story of which is told on this page. Photograph by courtesy of Mr. O. A. Collins, Gundagai.

teamsters, and settlers who followed close on the heels of the explorers Hume and Hovell from 1824. These hardy sons of Australia, facing the unknown, struck this Hume Highway with their caravans whilst passing on to the present Riverina, the great tract of fertile land in New South Wales that is watered by the Murray, Lachlan and Murrumbidgee Rivers.

In later years the discovery of gold in this district brought a rush of many thousands, and this spot, with its racecourse and its hotel, the ruins of which can still be seen at the back of the monument, became the rendezvous of all classes, including bushrangers, some of whom danced at the hotel and raced their horses at the race meetings.

It was whilst escorting gold along this road that Sergeant Parry, of Gundagai, was shot dead by Gilbert, one of a gang of bushrangers. Later, the notorious "Moonlight" and his gang also exploited this territory, and were afterwards captured and tried at the present Gundagai Courthouse for the murder of Senior Constable Bowen. The latter and two of the bushrangers were buried in Gundagai Cemetery.

For the story of the monument at this historic spot we are indebted to Mr. O. A. Collins, Gundagai.



"Bill," a gull who is a familiar figure in the fish market at Brixham. Photograph by A. Lamsley, Southsea.

"Bill" of Brixham

"Bill," whose photograph is reproduced above, is one of the largest gulls in the fish market at Brixham, Devonshire. He is known by most of the men, and occasionally shares their meals by the quayside.

I was waiting on Brixham quay for a yacht's tender to take me out into the harbour, and having a sandwich whilst waiting. "Bill" joined me and shared my lunch. He became greatly daring, and picked up crumbs that I dropped only two feet away from me. Then I took this snap of him, which is considered one of the most natural and lifelike ever taken of a seagull. A. LAMSLEY.

Giants of the Forests

Plants afford a most amazing contrast in size. On the one hand there are some that cannot be seen without the aid of a microscope, and indeed are so small that 50,000 would have to be placed in a line to make an inch. At the other end of the scale there are the eucalyptus trees of Australia and the sequoias of California, the giants of the plant world.

Eucalyptus trees sometimes reach a height of 450 ft. to 500 ft. The sequoias are even more remarkable, for although they are not as tall they have a tremendous girth, and are claimed to be the world's largest trees in bulk. In the Calaveras Grove in Southern California, a house has been built on the top of a sequoia stump 27 ft. in diameter. Another of these trees in the Yosemite National Park is known as the "*Grizzly Giant*," and has a diameter of nearly 30 ft. and a height of 204 ft. A road actually has been cut through the base of the trunk of one huge Californian sequoia, known as "*Wawona*" and motor cars can pass through it quite easily.

The banyan tree, which is very common throughout India, is another giant of the forest, but it extends sideways. It throws out aerial roots from its branches, and these grow down to the ground and penetrate the soil, so that in time each tree becomes a wood in itself! A specimen in the Royal Botanical Gardens, Calcutta, is particularly famous for its size. It is only 89 ft. in height, but it has 23 of these roots that are as large as those of oak trees and more than 3,000 smaller ones. Over 7,000 people are said to have stood at the same time in the shade of this immense tree.

A tree that is equally wonderful in a different way is the Big Tree of Tula, a Mexican cypress that stands in a churchyard at Santa Maria, to the south of the city of Mexico. Its trunk is 50 ft. in diameter, and it takes 28 people with arms outstretched and finger tips touching to reach round it.

A Unique Coin

How many of you have seen a coin on which is the reproduction of a motor car? There is only one coin of this kind. It is a silver dollar from Kwei-Chow, a mountain province in the remote interior of China. Very few specimens have found their way into the outer world, and these are chiefly in the possession of collectors.

The motor car shown on the coin was built in Detroit, the famous United States centre of the industry, and taken to Kwei-Chow nearly 12 years ago. As there were no roads on which it could travel, or railways over which it could be sent, the car was taken to pieces on arrival in China and these were carried to their destination in bamboo litters and on the backs of coolies. When they had been assembled the ruler of Kwei-Chow was so greatly impressed with the car that he decided to strike a special coin to celebrate the occasion.

"Slaves" in the Modern World

Many ancient cities had large populations, but most of their inhabitants seem to have been slaves. It has been stated that about 317 B.C. there were some 400,000 slaves in Athens, although the number of citizens and resident aliens was only 31,000, and there was certainly a far greater number of slaves than freemen.

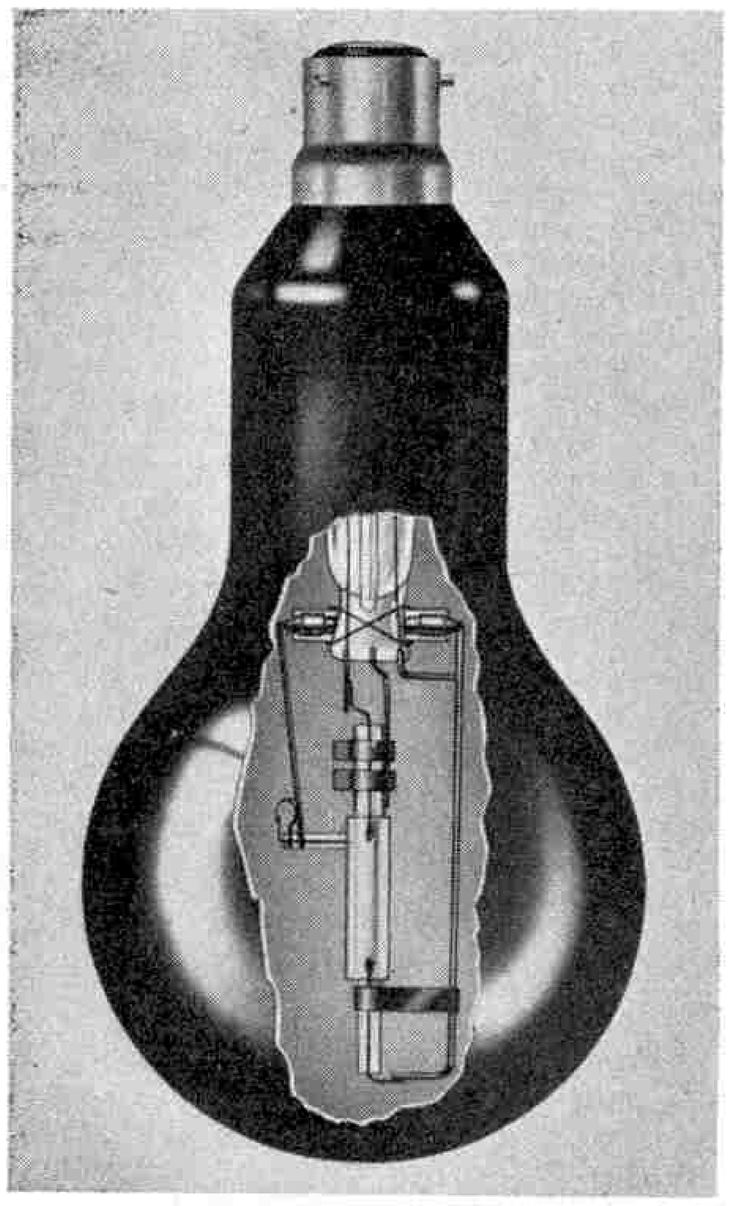
Strange as it may seem, there are far more slaves in a modern city than there were even in ancient Athens. To-day however the slaves take the form of machines using coal or oil as sources of power, and fulfilling our needs for light, heat, transport and many other things. A writer in the "*Compressed Air Magazine*" has calculated that every family in the United States obtains in this way the equivalent of the services of 400 human slaves, so that there are roughly 100 modern "slaves" to each inhabitant.

Invisible Light in the Laundry

Many startling effects can be produced with the aid of ultra-violet rays, which are themselves invisible but have the peculiar power of exciting various materials to such an extent that they become luminous. Advertisements and posters treated with special powders can be made to stand out in rich colours when flooded with these invisible rays, and strikingly decorative schemes have been designed on similar lines for restaurants, theatres and other places where colour and light are essential.

One of the most remarkable uses to which the ultra-violet rays have been put is in detecting the distinguishing marks used at laundries. These marks can now be applied by means of special ink that is invisible in ordinary light, but shows up strongly as soon as ultra-violet rays fall upon it. The marks can be placed anywhere on the articles to be distinguished, and may be larger than those usually employed, for they cannot be seen in ordinary light, and thus the necessary sorting at laundries in the light of ultra-violet lamps can be carried out rapidly and easily.

The lamp that is shown in section in the accompanying illustration is a new one introduced by the British Thomson-Houston Company Ltd. for purposes of this kind, and is a very efficient and practical source of the rays. It requires a voltage of 220-260, and must be used with a choke, but voltages of 200 to 220 can be used if a suitable transformer is provided. The lamp is provided with a three-pin cap instead of one of the two-pin type so that it cannot be fitted by mistake into sockets not wired for it. It has two envelopes, an outer one of glass that practically cuts off ordinary light, and an inner one of fused quartz, that withstands the high temperatures reached, and both readily allow the ultra-violet rays produced by an arc in the lamp to pass through. The rays can be directed by means of aluminium reflectors.



The Mercra ultra-violet ray lamp. Photograph by courtesy of British Thomson-Houston Company Ltd.

The Hedgehog and Its Ways

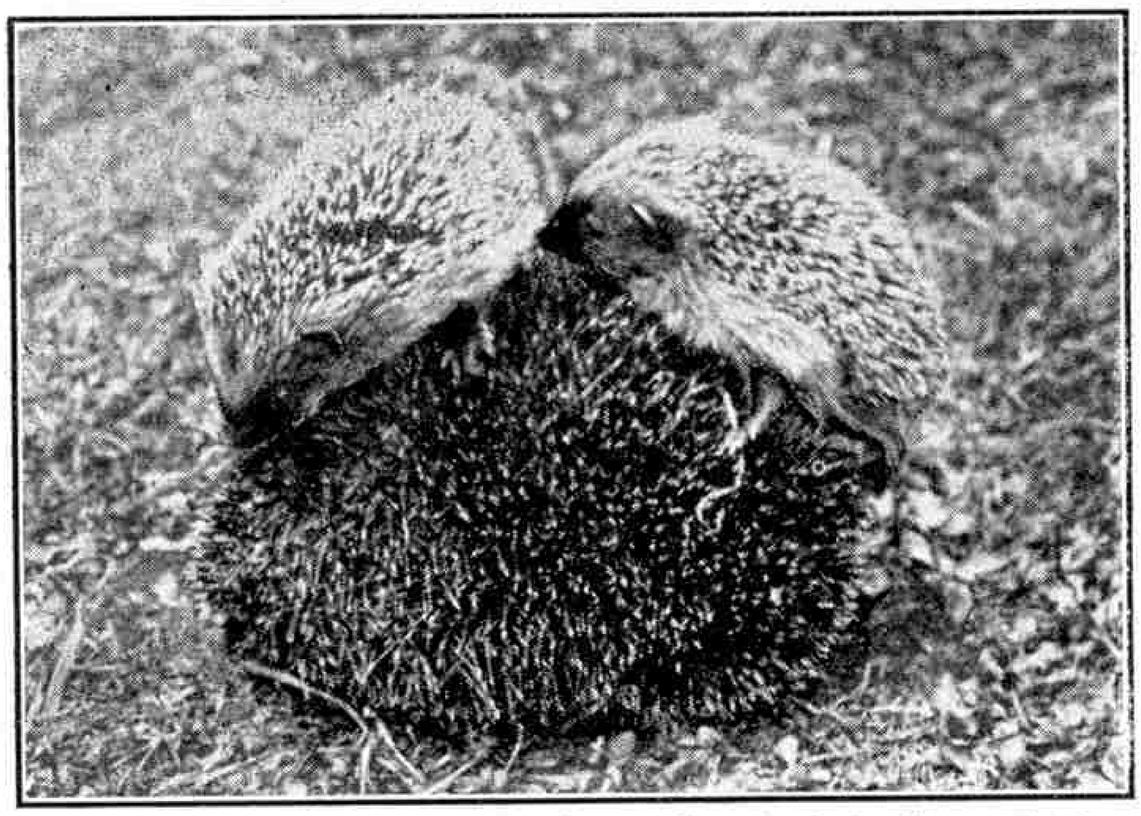
Peeps at an Interesting Animal

By J. C. Bristow-Noble

I OFTEN think it strange that hedgehogs, which are so tortoise-like in their movements and helpless, still survive in this crowded country, but as it happens there is a good number of the useful, interesting creatures. From spring to autumn the animals live in the hedges and among the under-growth on the fringes of the copses and spinneys; and from autumn to spring in the mouths of the rabbit burrows and of dry drains, and in any little cave they come across.

A nest, complete with a roof, of first dead grass and then dead leaves, in a position, if possible, where it is reached by the sun, is their bed. When a hedgehog enters its small home it carefully closes the doorway behind it by filling it with grass and leaves, and on going out closes it again in the same way.

I have watched through hours of a summer's evening, at a distance of a dozen feet or so, to try to see a hedgehog leave its nest, but always the hedgehog has tricked me. It has cunningly contrived to slip away without my hearing so much as a faint rustle, much less catching a glimpse of it; and on searching for it I have found it a hundred yards or so distant, or not at all. The animals lie in the nests on their sides or on their feet with their quills laid back flat against their bodies.



A prickly climb. Baby hedgehogs creeping over the spiny back of their mother.

It is when the leaves begin to fall and the wild grass to die and turn brown that they take up their quarters in the entrances to the rabbit burrows and in the little caves along the hedgerow banks. It is only a foot or so inside the rabbit burrows that the hedgehogs are found, and generally the whole mouths are filled tightly with leaves. The rabbits forsake the burrows immediately, though there may be several other entrances and they need not use the one in which the nest has been built. What is the bunnies' objection to a hedgehog I cannot conceive. They simply will not live with one under the same roof.

Rats, also, give the hedgehog a wide birth, and though a stoat could easily kill one by watching its opportunity and seizing it by the throat, yet, I believe, none has ever been known to do so. On the other hand, if a badger comes across one it will either ignore it or carry it away and kill it and consume it at its leisure. What Brock does depends on whether he is hungry or not. The fox, also, is thought to kill and feed on one occasionally.

When there is snow and severe frosts the animals hibernate, for there is no food for them. I have often searched for hedgehog tracks on snow, but never found any, and after even a light fall I have noticed that the creatures will not venture out of their nests until every trace of it has disappeared.

Another tiny hedgehog poses for its photograph.

Gamekeepers butcher all the hedgehogs they come across and give them as food to their ferrets. Gamekeepers are the hedgehog's only enemies, apart from Brock, and the gypsies and countryside higglers, who collect them and dispose of them in the towns to be kept as pets, and put down in warehouses and cellars, and in private and market gardens to keep the places free of beetles, slugs, and similar unwelcome intruders.

Some gypsies like a hedgehog to eat. The flesh is said to be delicate and rich, and it should be; snails and slugs, at least those of the country, are rich food.

The method of most gypsies of cooking a hedgehog is to encase it with clay and place the whole on their camp fire. In about half an hour the baking is complete and the "joint" is lifted from among the flames on to a dish. The clay is then broken and the quills and skin come away with it. Next the carcase is placed on another dish and served with vegetables and gravy.

A rare occurrence is to find two adult hedgehogs living together. For my own part I have never done so, though I have found some of the creatures in every month of the year. It has always been only one to each nest.

Some country people are of opinion that hedgehogs will suckle cows as the latter rest dozing in the meadows at night. It may be true, yet few and far between are the cows that will allow so great a liberty to be taken with them. Certainly, it is not anything out of the ordinary to find hedgehogs nosing about round cows as they lie on the ground after nightfall, but according to my own observations the attractions are not the cattle themselves and their milk, but the beetles, cockchafers, and other insects that congregate round the herd.

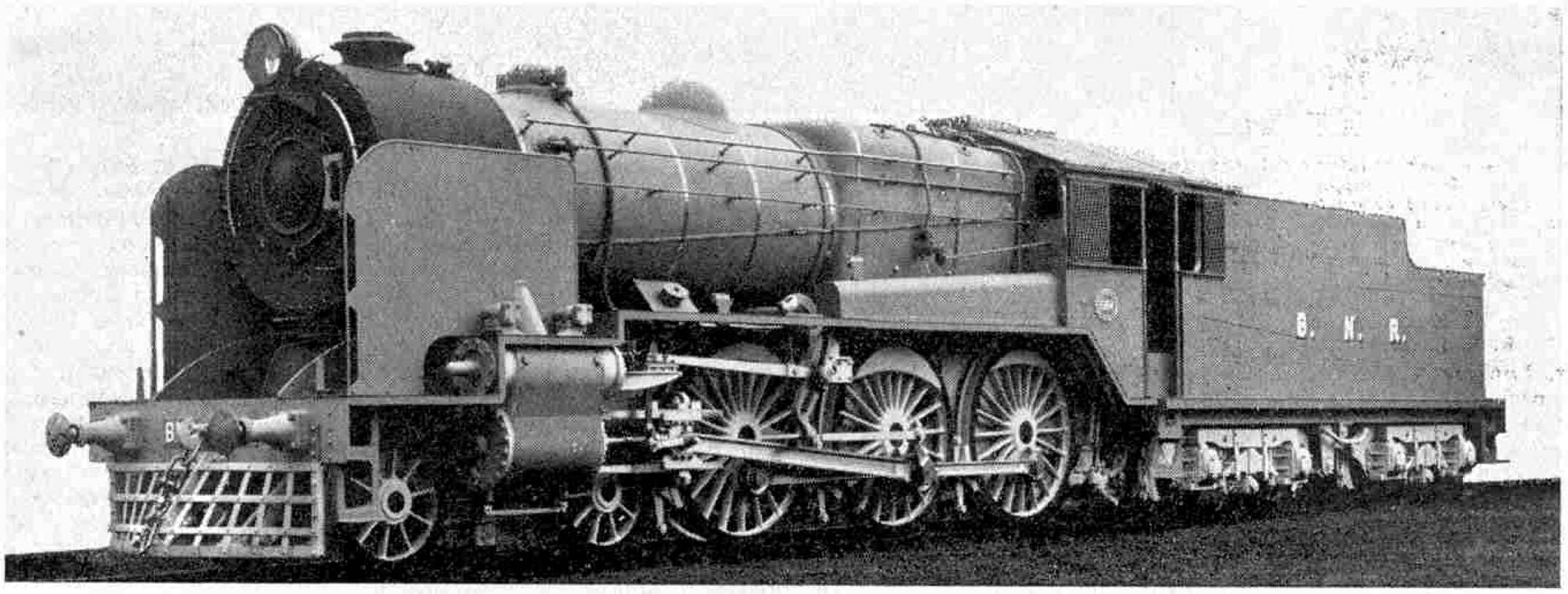
There are few more silent creatures than our friends. If a young one of a few weeks gets separated from its parent and brothers and sisters it will call for them with a soft, plaintive cry that resembles a whistle; while as the babies play they make a noise, only audible up to a few feet, not unlike the snapping of brittle twigs. But I have heard the voice of adults only on their being caught in gin traps and when being killed by dogs.

As pets the animals are most satisfactory when confined in a garden or orchard from which they cannot escape, or in an enclosure on grass of wire netting. Small, snug, rain-proof shelters filled with hay and leaves must be provided as sleeping, hibernating and resting quarters. In a short time the creatures will become very tame and make themselves into balls only when visited by strangers, and strange dogs. They may be fed with bread and milk, lettuce leaves and other delicate green food, and scraps of shredded raw mutton and beef. In a small orchard or garden two or three are not likely to find enough natural food the year round to satisfy them. I remember liberating a pair of hedgehogs that I had kept for some years in a wire netting run. They did not go far away, but remained in the surrounding meadows and fields until they chanced to be noticed by a party of picnicking motorists who caught them and carried them off in the car. The incident was witnessed by a shepherd, but unfortunately he arrived on the scene too late to rescue the little creatures.

In hutches, cellars and warehouses hedgehogs, of course, are not long lived. Few seem to survive longer than a year or so. In their wild state or when confined in a garden or orchard, Mr. and Mrs. Hedgehog will live for upwards of fifteen years.

British-Built Engines on Indian Railway

Long Runs on Mail Services



GENERALLY speaking the steam locomotives in operation in India are very similar to those in use in this country, no doubt due to the fact that many of the engines running on Indian systems have been supplied by British locomotive builders. Two new locomotives recently put into service on the Bengal Nagpur Railway are examples of this, for features of British design with modifications to suit local conditions are strongly evident in them. They were built at the Works of Robert Stephenson and Hawthorns Limited, Darlington, under the supervision of Sir John Wolfe Barry and Partners, consulting engineers to the Bengal Nagpur Railway, and are employed on the broad gauge section of that Railway, which has 2,285 miles of track of the Indian standard of 5 ft. 6 in., but also includes 926 miles of track of the 2 ft. 6 in. gauge that feeds the broad gauge lines. The chief routes of the railway form sections of the through connections between Calcutta and Bombay and Madras. Mail and other trains run daily between these places, and in addition the lines carry a heavy coal traffic from the Bengal coalfields.

The Bengal Nagpur locomotive shown above is of typically British design, but incorporates various modifications made necessary by the requirements of service in India, such as the combined engine-and-tender cab with its louvred shutters. We are indebted to Robert Stephenson and Hawthorns Limited, Darlington, for this illustration and for the information given in this article.

The new engines are known as the "G S M" class and are a development of the "G S" 4–6–0 class, already in operation on the Bengal Nagpur Railway, which has become unequal to the heavy demands of the present-day mail train traffic. Although they incorporate certain details and fittings of their predecessors, they are really a new design, with coupled wheels of 6 ft. 1½ in. diameter, and a coupled wheelbase of 13 ft. 10 in. The total engine wheelbase is 26 ft. 7 in. The tractive effort is 27,787 lb. at 85 per cent. of the boiler pressure, and the total weight of engine and tender is 140 tons 11 cwt.

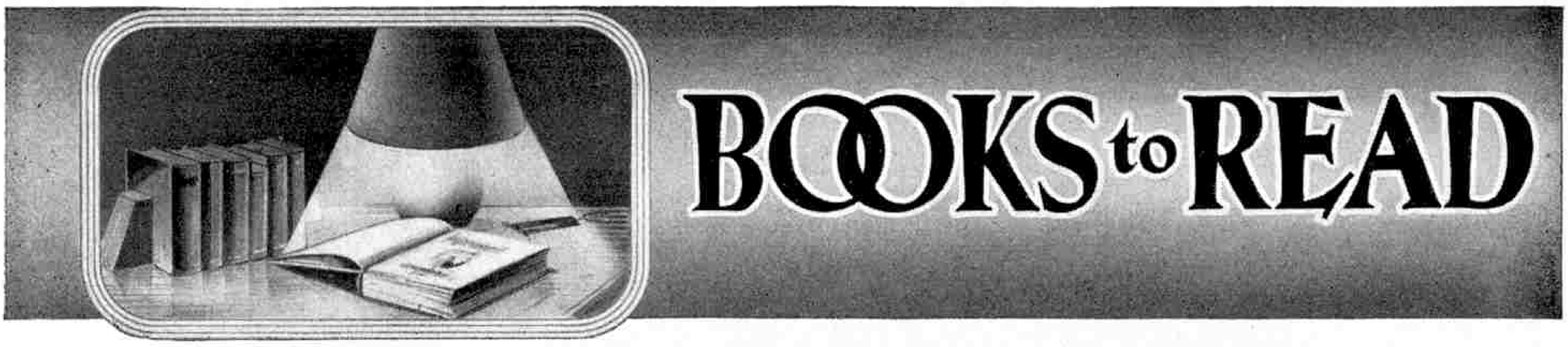
The smoke-deflectors, squat chimneys and top-feed apparatus approximate to British standards, but the combined engine-and-tender cab with its louvred shutters cannot be likened to anything in this country. This type of cab is typical of Indian practice. An interesting footplate feature is the container on the left-hand side of the engine for carrying the firing tools. The arrangement of this container allows the tools to be inserted and withdrawn without the inconvenience of turning them round, as is necessary when they are carried on the tender.

The cylinders of the engines are 21½ in. by 26 in. and are bolted to the main frames with a steel box casting between them. Above the casting runs a horizontal frame stretcher, which commences at the front buffer beam and is carried back to form a continual system of horizontal staying covering the cylinders and driving axle.

The leading bogie is of the sliding type and both the engine and bogie liners are made of "Salvobestos," a material for which it is claimed that no lubrication is required. The solid bronze coupled axle-boxes are oil-lubricated by gravity feed from external oilboxes. The valve gear is also oil-lubricated by means of oilcups and syphons, but the cylinders and valves are lubricated by means of a Wakefield sight-feed lubricator.

The tender is carried on two four-wheeled bogies and weighs 65 tons 13 cwts. It is designed to carry 10 tons of coal and 4,750 gallons of water. The axle-boxes of the tender, and also the engine bogie, are equipped with roller bearings. In 1934 one of the "M" class 4–6–2s of the Bengal Nagpur Railway was fitted experimentally with a roller-bearing bogie having boxes of a design similar to that now in use. The improved riding of the engine was particularly noticeable, and it is in consequence of this that the new engines have been equipped with the same arrangement.

Improvements in accessories and details, such as those incorporated in these engines, are increasingly important under modern conditions, where the tendency everywhere is to obtain more intensive use of locomotive power. Extended engine runs are now regular practice on the Bengal Nagpur Railway and at the moment, according to the "*Railway Gazette*," certain Calcutta and Madras mail trains are worked in each direction over the 547 miles between Howrah and Waltair by one engine. It is likely that this figure will be exceeded before very long.



Here we review books of interest and of use to readers of the "M.M." We can supply copies of these books to readers who cannot obtain them through the usual channels. Order from Book Dept., Meccano Limited, Binns Road, Liverpool 13, adding 1/– for postage to the price. Postage on different books varies, but any balance remaining will be refunded.

"I Know An Island"

By R. M. Lockley. (Harrap. 10/6 net)

Mr. Lockley is too modest in his title; he knows many islands and writes about them so well that his readers cannot help liking them. The one that he knows best, and the starting point for his travels to others, is Skokholm, one of the group off the Pembroke coast, on which he has lived for over 10 years. We take part with him in the building of a home secure against Atlantic storms, and in his everyday activities; and enjoy his fascinating stories of the puffins, gulls and razorbills of his island, and of the migrant birds flying up and down the coast that rest there a while.

From Skokholm Mr. Lockley has made visits to other lonely islands in search of rare birds and interesting people. Among the islands he describes are Grassholm, where there is the famous gannetry, and Ramsey, which is cut off from the Welsh mainland by fierce tide races. These belong to the same group as Skokholm. Farther north is Bardsey, a wonderful little island of neat farms, and off the Irish coast are the Blaskets, the most westerly bits of land in the whole of the British Isles. Then he roams farther away, to Heligoland, where there is a famous garden in which birds are trapped, ringed and released; to the wild and desolate Fair Isle; to the Faroes, and lastly to the Westmann Islands, off the coast of Iceland.

Mr. Lockley writes in the most interesting way possible of the people of these islands and the way they live, and his descriptions of the scenery make us long to visit every island. This is a book of special fascination to all lovers of sea birds, but even to those who have little knowledge of birds every page is full of interest. This book is well illustrated by photographs and can be recommended to everybody.

Gannet feeding young on Grassholm. From "I Know An Island," reviewed on this page.

"Modern Table Tennis"

By J. Carrington. (Bell. 2/6 net)

Table tennis is one of the most fascinating of indoor games, and one that demands fitness and skill if full benefit is to be derived from it. How to acquire this skill is well shown by the author, who has been successful in many tournaments and is an attractive writer. His treatment is concise and practical, and what he has to say can be read with advantage both by beginners and more experienced players. Interesting chapters on championship playing and a section giving the laws of table tennis complete a very interesting book, which is illustrated by means of diagrams and four full page plates.

"Swords in the Dawn"

By J. Beaty. (Harrap. 5/– net)

The wielders of the swords in the dawn are Hengist and Horsa, the wanderers from the north who led the Saxon invasion of England. In the story we see the two famous brothers before their departure from their home in Denmark, and follow them throughout the stirring period when they fought the battles of Vortigern, the Kentish king, and so won the Isle of Thanet for themselves. Stern battles and fierce individual combats figure largely in this excellent story. The action is based on historic events, the men taking part in them being as real as knowledge of those ancient times can make them. There is a coloured frontispiece and 12 full page illustrations.

"The Baby Giant Panda"

By Ruth Harkness. (Harrap. 5/– net)

This is the story of the babyhood of Su Lin, the first giant panda ever captured, and it is told by the explorer who found her and brought her from her mountain home on the border between China and Tibet to New York. Giant pandas are rare, and had never been seen by Europeans until 1929, when two Americans shot one. Later other hunters were similarly successful, but the lives and habits of these animals remained a mystery until by a stroke of remarkably good fortune, Mrs. Harkness, while trying to capture one of the creatures alive, discovered a baby panda in an old tree trunk.

How this happened is vividly described by Mrs. Harkness, who then proceeds to tell the story of her daily life with her strange pet, which in appearance resembled a woolly bear and proved astonishingly docile and lovable. Getting Su Lin down to Shanghai was a difficult task, for she had to be fed and nursed like a baby, while a porter carried her in a basket along primitive trails, sometimes on narrow ledges high up on cliffs, and over foaming torrents by means of rickety suspension bridges or even fallen tree trunks. The newcomer created a sensation on her appearance in Shanghai, but this was completely eclipsed by the amazing interest that was taken in her on arrival in the United States, where she was photographed and interviewed, and even took part in radio broadcasts. All this time she grew rapidly, and finally a home was made for her in the Chicago Zoological Park at Brookfield while her discoverer went back to China to find a friend for her, a quest in which she was successful, finding yet another baby female.

All who are at all interested in animal life will want to read Mrs. Harkness' story, which gives a remarkably full account of the appearance and ways of this curious animal, together with an extensive series of wonderful photographs showing her at practically every stage of her career.

"The Wonder Book Of Would You Believe It?"

(Ward Lock. 5/- net)

Every reader of the "Meccano Magazine" delights in strange and wonderful things and happenings, and in this splendid volume, with its crowds of interesting pictures, they can read of scores of things that seem unbelievable, yet are perfectly true.

The book is so crowded with information that it is only possible to give an indication of its contents. We read of trees turned to stone, of an entire white city underground in the salt regions of Poland, and of glass so strong that a sheet of it will sustain the weight of an elephant. We are assured that there are places where it has rained frogs and fishes, and we read about curious fish covered with spines, and even of one with a bony horn projecting between the eyes, like that of the fabled unicorn. There are stories of the Sun, of heat and cold so intense that they defy imagination, and of plants that eat animals, an unexpected reversal of the usual order of things.

All these and many more equally strange facts are simply described and explained, and the wonders of the book are splendidly illustrated by means of eight colour plates and nearly 300 other illustrations. We cannot imagine a boy who will not revel in such an immense store of knowledge so well selected and so vividly conveyed by him.

Inside the crater of Vesuvius. From "The Wonder Book of Would You Believe It," reviewed on this page.

"The Flying Kidnappers"

By Michael Cronin
(A. and C. Black. 3/6 net)

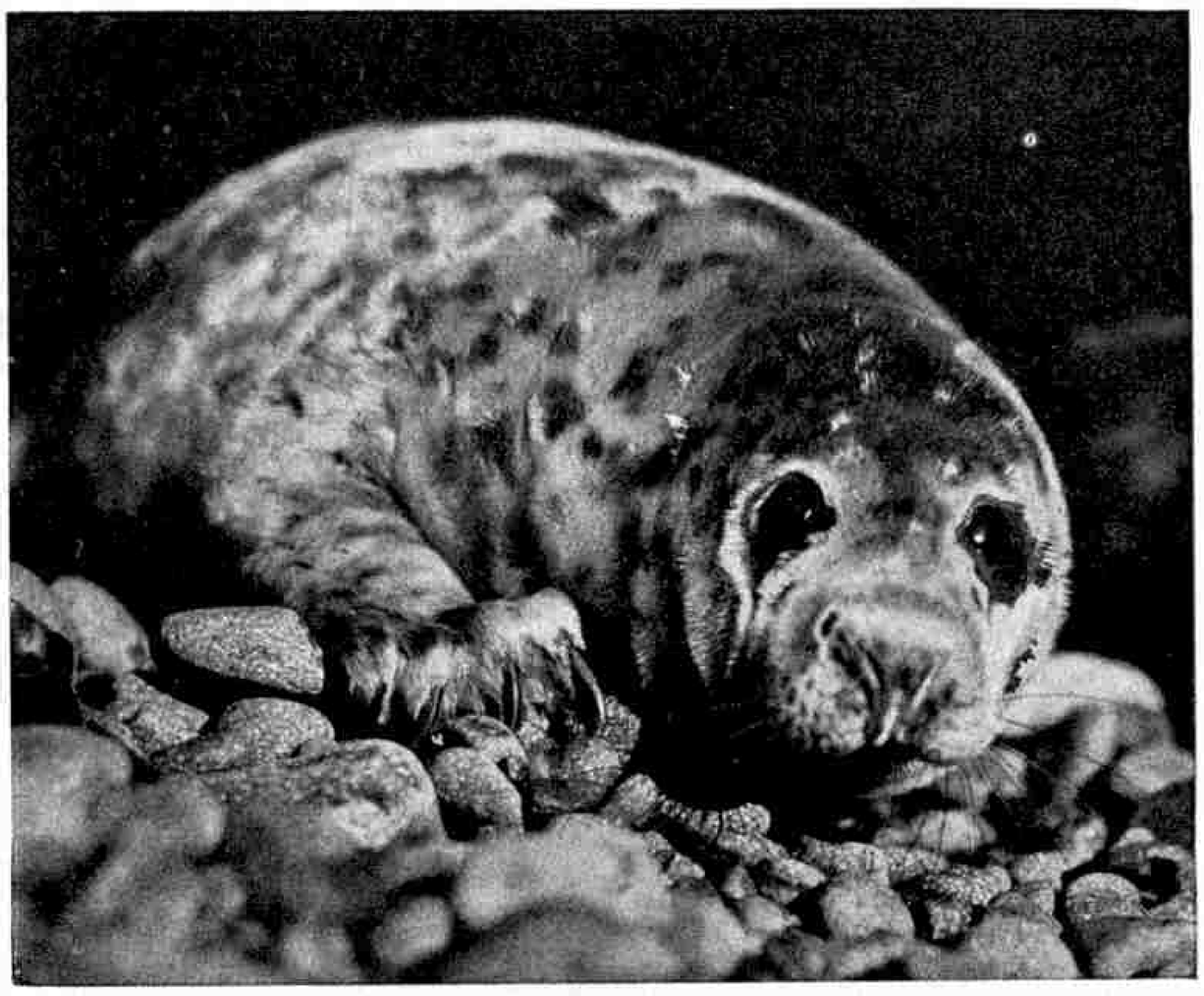
A story of adventure in fast aeroplanes and high powered motor launches, with a real thrill on almost every page. It concerns the activities of an international arms gang run by an unscrupulous adventurer, who tries to prevent Colonel Bellairs from developing a wonderful new aeroplane by kidnapping his son Roger and Sam Wilson, an American friend, and threatening to mutilate and even shoot the prisoners. Then the fun begins. The boys lead their captors a fine dance on the lonely Scottish island to which they are taken, and eventually escape in a triumphantly audacious manner, forcing the leader of the arms gang to fly them back. The flight ends with a dramatic crash on the coast of Sussex. The gang is broken up, and the story closes with the highly successful trial flight of the new aeroplane. There are four full-page illustrations.

"101 Things for a Boy to Make"

By A. C. Horth. (Batsford. 5/- net)

Most boys like to make useful things and do odd jobs in the house, and here is a book that will be just the thing for them. Its practical value is proved by the fact that this volume is the third edition, which is considerably revised and enlarged. In it are countless suggestions for hobbies of all kinds, including tasks for the woodworker and metalworker, for the young engineer, and for all who enjoy making models.

It is not necessary that the reader of the book should have a specially-fitted workshop in order to follow out the instructions given, for many of the useful things described can be made on the kitchen table or by the fireside. Special attention is paid throughout to the use of tools, and in addition to a large number of constructional drawings there are 31 photographic illustrations, showing how to carry out various operations, such as planing, sawing and chiselling, of which the handyman should be master.



A grey seal calf on Ramsey. From "I Know An Island," reviewed on the opposite page.

"The Compleat Smuggler"

By J. Jefferson Farjeon. (Harrap. 10/6 net)

The smuggler has been variously described as a wretch who defies the law and as an honest thief. Whatever he may be, the story of smuggling provides more excitement than any thriller, as Mr. Farjeon's excellent book shows.

Smuggling is a very ancient art, but as far as this country is concerned, it began with the "owlers" of Romney Marsh, who started smuggling wool out of England in order to dodge export duty, more than 600 years ago. The battle of the wool raged for over four centuries, and was succeeded by an even more stirring struggle in which smuggling gangs were constantly at warfare with excisemen. The smugglers were well organised, both at sea and on land, and merciless towards excisemen and informers. This is well shown by the doings of the "Hawkhurst Gang," who terrorised the country east of Tunbridge Wells, and by even more terrible tales told by the author.

The story passes on to the amazing escapades of smuggling rascals, some of them attractive, in spite of their occupation, and others the reverse. It is not only of the men themselves we read, but also of the ingenious ways they had of hiding cargo and running smuggled goods across country to their destination. Tubs of brandy sunk on a line at sea, waiting to be retrieved on a favourable opportunity, strange hiding places in cellars and lofts and even in tombs, and cavalcades with armed guards loom largely in the book. Finally comes a chapter on modern smuggling with the aid of aeroplanes, motor cars and motor boats.

The book provides a wealth of variety and exciting reading, and is illustrated by many spirited drawings.

"Heroes of British Life-boats"

By G. Shairer and E. Jameson
(Harrap. 7/6 net)

The authors of this interesting book have talked to life-boatmen about their work, and their tales are of heroic rescues in the wildest and fiercest of storms, and of dogged courage and endurance in the most difficult circumstances. The writing is dramatic and vivid. A conversational story form is adopted throughout, but many readers probably would have preferred more actual stories of life-boat rescues to much of the talk about incidental matters that also is included. There are 16 illustrations in half-tone.

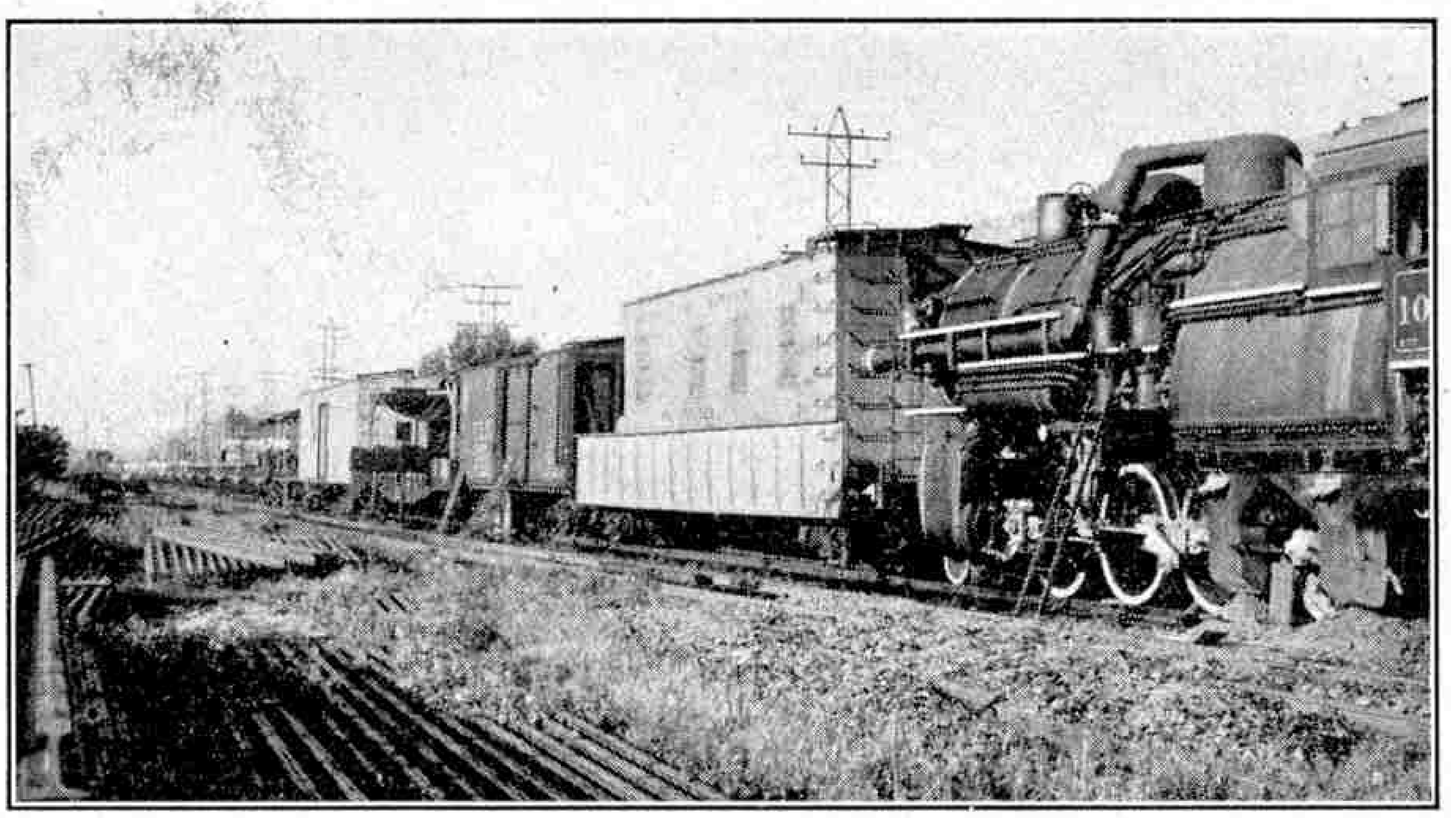
Welded Rails Over a Mile in Length

"Velvet Track" on a United States Railway

A CHARACTERISTIC feature of any journey by rail is the rhythmic beat of the wheels over the rail joints; it is in fact hard to think what a journey would be like without this song of the wheels. Much has been written about rail rhythm, but for all its fascination and the use to which it is put by enthusiasts calculating the speed of trains, there remains the fact that rail joints are a continual source of worry to the permanent way engineer.

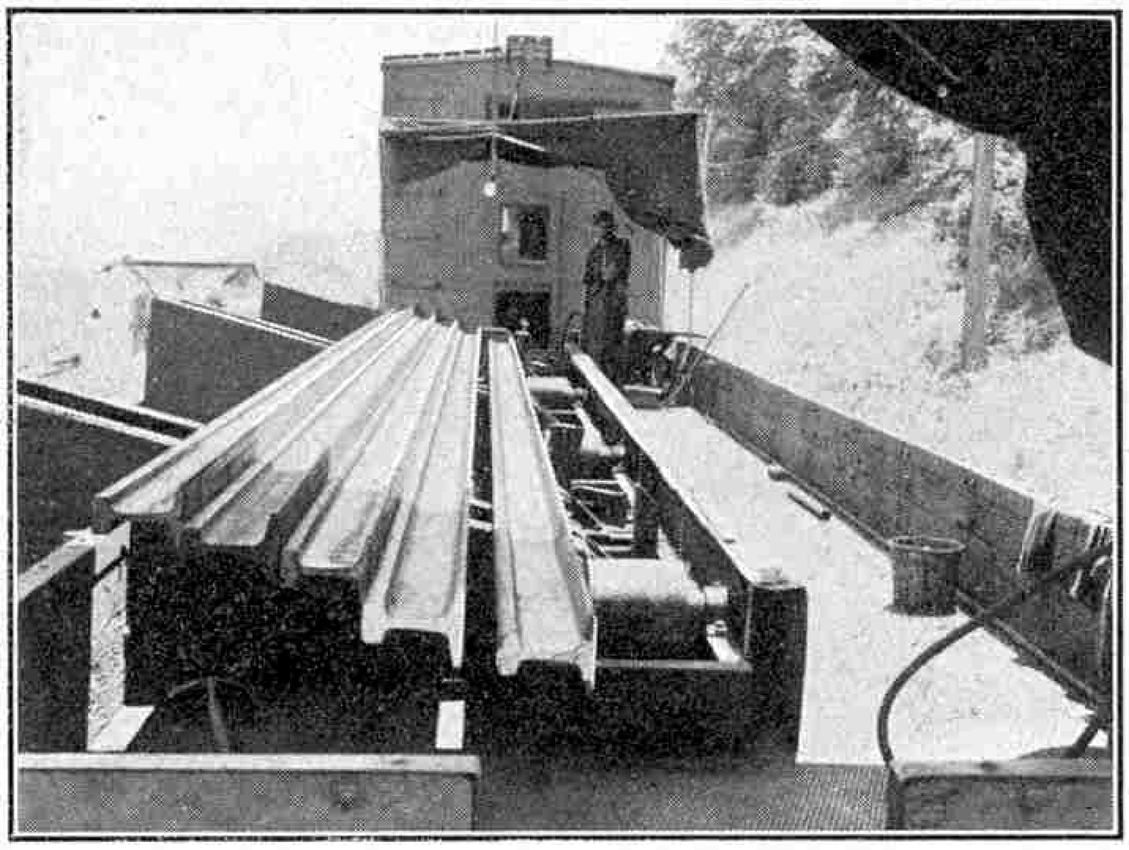
To abolish what has long been considered a necessary evil has been a dream of those entrusted with track maintenance for many years. The reduction of the number of rail joints has been effected to some extent by the gradual increase in the length of rails. A good many years ago the former L.N.W.R. were pioneers in this country in the use of rails 60 ft. long, which were rolled in the Company's own works at Crewe to replace the 30 ft. and 45 ft. rail lengths previously in use. Since the War however the 60 ft. rail has been adopted as a general standard, for main lines at least. In addition as previously recorded in the "*M.M.*," 90 ft. and, more recently, 120 ft. rails have been successfully produced and laid in certain sections of the L.N.E.R. and L.M.S. main lines, the principle followed being that the longest rails that can be conveniently manufactured can be safely used.

The application of welding to rail joints, thus producing even longer rails, has been carried out to some extent in special instances in this country such as in Merstham Tunnel on the S.R. The practice has been applied more widely on the Continent, especially in Germany, where continuous lengths of welded rail more than 400 ft. long have been in use in tunnels and on bridges. The realisation of the permanent way engineers' dream to abolish joints as far as it is possible to do so however is in some measure being realised in the United States, where the Delaware and Hudson Railroad in conjunction with the welding specialists Sperry Products Inc., have laid down what has become famous as "velvet track." Apart from the smoothness of running thus obtained there is a saving in the amount of maintenance required. The importance of this will be realised when it is stated that more than 45 per cent. of the work put into track maintenance is taken up in keeping the rail joints of ordinary track in proper order.



The welding train referred to in this article at work on the Delaware and Hudson Railroad. For the illustrations to this article, and the information given in it, we are indebted to Sperry Products Inc.

With characteristic American hustle over 7,000 rail joints were eliminated on the Delaware and Hudson during 1937, and to carry out the work on what may be termed a production basis a special self-contained equipment train has been evolved. This forms literally a mobile electric welding, heat treatment and grinding plant, from which the rails, after having been welded together into continuous lengths of 780 ft. or more, can be unloaded over the end of the train on to the lineside ready for re-laying.



A view along the rail rack car of the welding train. Standard rail lengths in the rack are waiting to be fed into the welding car in the background by means of the power rollers shown.

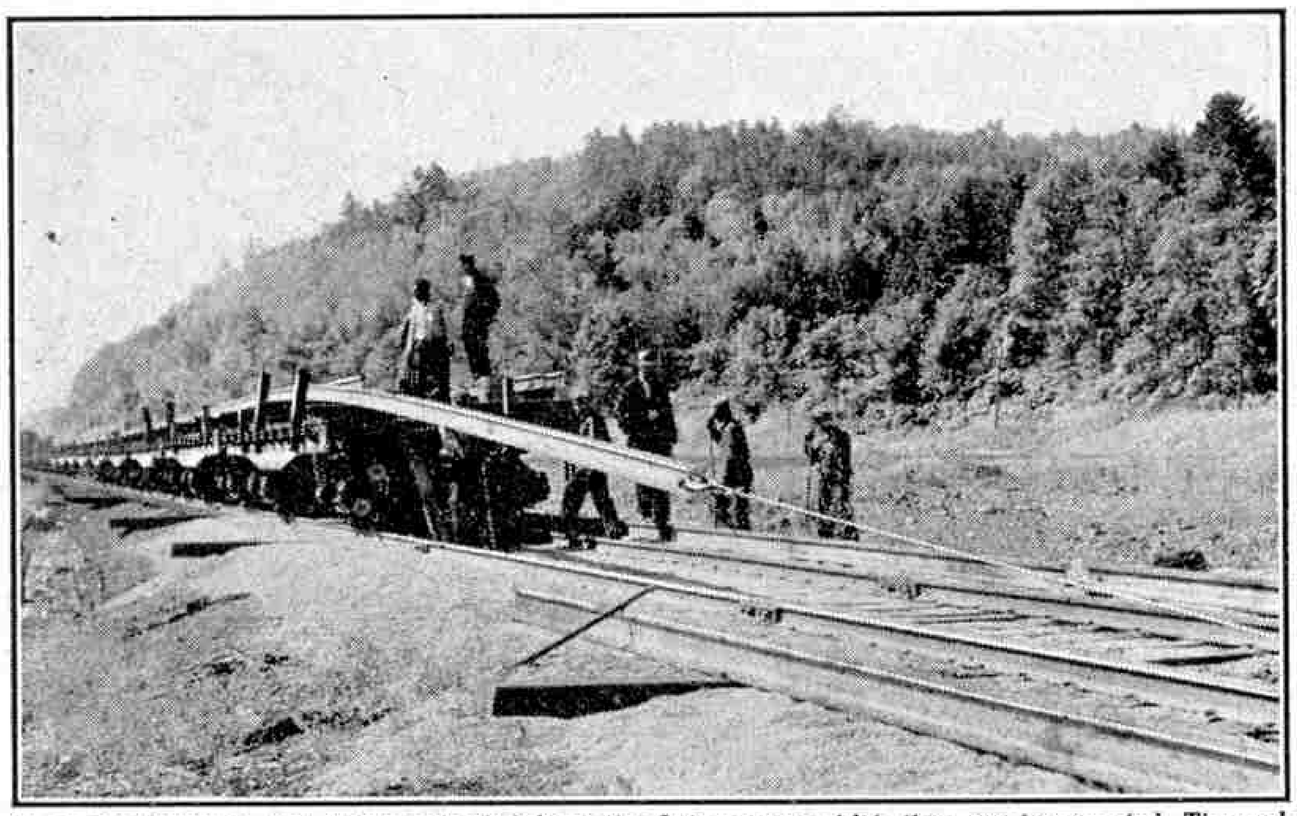
The upper illustration on this page shows this most interesting train, which is hauled about from point to point as required by a steam locomotive. The current used in the electric welding process is produced by turbine generators housed in a car situated next to the engine, the steam supply to the turbine being obtained from the locomotive by means of a special connection to the dome. The steam pipe leading from this is clearly visible in the illustration referred to, passing forward from the locomotive and entering the end of the generator car. The next vehicle connected with the welding process is known as the rail rack car, on to which the separate rails are loaded in tiers by a crane. At the bottom of the sloping rack on which the rails are held is a series of

rollers that make it easier to feed forward each rail in turn to the next car, in which the welding operation takes place.

The process employed is known as flash butt welding, in which the parts to be joined are butted end to end, and is carried out by a special machine in which the process is automatically controlled and sound welds are ensured. The making of the welds involves three steps—pre-heating of the rail ends to be joined, flashing, and a push-up. When arranged for welding, the rails are gripped between clamps and contact pads, through which the current is applied. In the pre-heating operation, the single rail, fixed to a movable platen or table, is moved up so as to make a momentary contact with the end of the fixed rail. This causes a short circuit of the current, which in a short time raises the temperature of the rail ends to practically a fusing heat.

After welding and heat treatment the joints are dressed by means of portable grinders. In this illustration the upper side of the rail base is being ground to remove superfluous metal.

When this stage is reached, the flashing operation is carried out. This involves continuous short circuiting of the welding current by bringing the rail ends into continuous contact. In this operation, the steel immediately at the rail ends changes to a molten state and flashes out from the contact faces, removing any rough spots or oxidized metal on the rail ends. The rail ends are then squeezed together under hydraulic pressure, when the molten ends fuse into each other, producing a collar of molten metal known as "upset" around the periphery of the rail at the point of weld. Immediately following this operation, the clamps on the movable platen of the machine are released from the rail. The platen then is moved forward under hydraulic pressure to a point where it shears off the upset metal on the underside of the rail base, thus leaving it quite smooth.



A string of welded rails being unloaded from the flat cars on which they are transported. The end of the rail is anchored to the track and the train moves on, thus depositing the rail on the permanent way.

After the welding car come a series of five flat cars, on which the welds are treated to fit the rails for service in the track. The first of these operations is intended to relieve any stresses set up around the area of the weld, due to the great heat concentrated over a small area during the flash welding process, and is carried out by heating the rails in the neighbourhood of the welds to a certain temperature. An oil-fired oven is used for this purpose.

Next the portions of the upset metal not required are ground away. The unwanted metal about the weld is first removed from the sides of the rail head, then the underside of the rail head and the upper side of the rail base are attended to, and finally comes the rough grinding of the rail head itself. As the continuous length of rail is extended by each new weld it is pulled forward the correct distance on to further cars for storage. This pulling is carried out by means of a cable and an electrically-operated winch situated at the far end of the storage cars.

The rails are welded into continuous strings each 1,000 ft. long, and as many as 12 such lengths can be lined up on flat cars and transported to the site where they are required for relaying. The rails are not tied down on the cars when they are on the way, but they bend readily and adjust themselves to the movement of the cars on curves in a remarkable manner. Even severe reverse curves can be traversed by shipments of rails loaded in this way.

On arrival at the place where they are to be laid the strings of welded rail are unloaded by anchoring the outer end of each in turn to the track while the train of flat cars draws forward. They are unloaded on to the outside of the running rails, and are then levered up on to the outer ends of the sleepers ready for the actual re-laying in the track.

During re-laying operations each string of welded rail is connected to the next by means of bolted fishplates in the usual way, but this is a temporary arrangement and joints are welded later to form even greater lengths of welded rail, some of which are 6,983 ft., or nearly 1½ miles in length. The "closure" welds are carried out by what is known as the "Thermit" process. This is a combination of pressure and fusion welding and involves the use of an inserted section of metal between adjacent rails and the upper parts of the webs of the rails. The purpose of this insert is partly to bring about the pressure necessary between the rail heads for making an effective pressure weld. At the same time it provides an opening between the rail bases for producing the fusion part of the weld. Several closure welds are usually made at a time by a number of independent welding gangs during periods of light traffic.

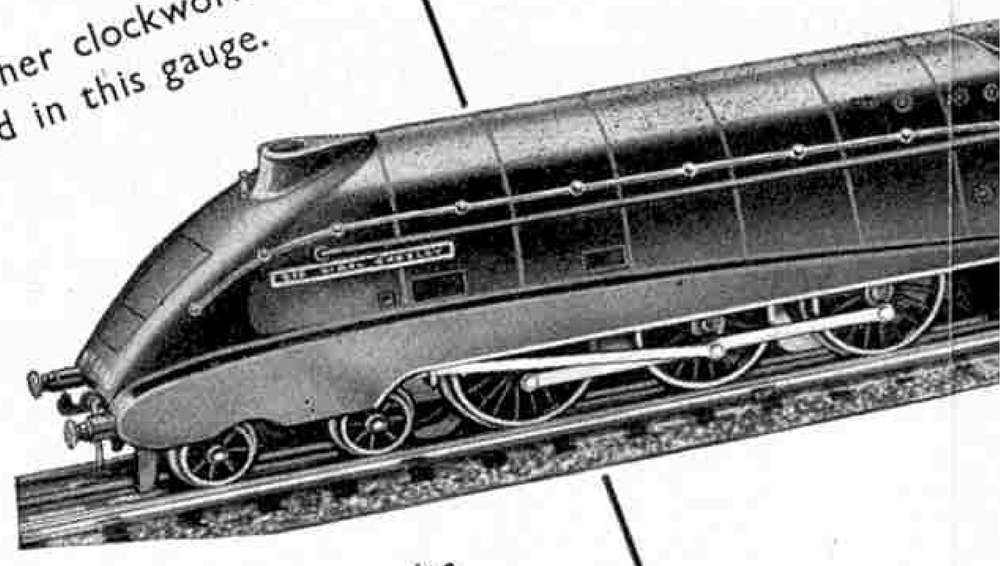
HORNBY-DU

GAUGE 00

THE PERFECT

Built to Scale
Realistic Details—Positive Remote Control

The new Hornby-Dublo System, Gauge 00, marks a wonderful advance towards the ideal home railway. You can lay out a complete and realistic railway on your dining-table! The Trains are one seventy-sixth of the size of real trains.



Hornby-Dublo Locomotives are fitted with motors (either clockwork or electric) of a power and reliability never before achieved in this gauge. All the movements of the Electric Locomotives are perfect—starting, stopping, reversing and speed regulation are all carried out by the movement of one lever, and the control is positive.

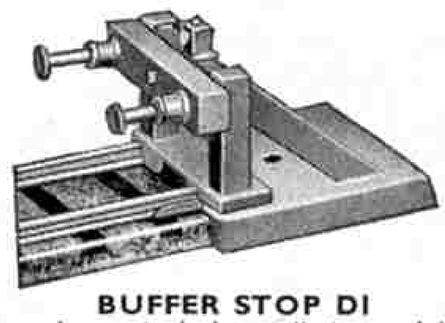
Automatic couplings are fitted to all Coaches, Vans and Wagons. The Signals are realistic working models of the latest upper-quadrant type and the Buffer Stops have working heads.

Hornby-Dublo Electric Trains operate on **Direct Current** at 12 volts. This current may be obtained either from **Alternating Current Mains Supply** through a Dublo Transformer, or from a 12-volt accumulator. The Dublo Transformers are specially designed for these Trains, and no others should be used.

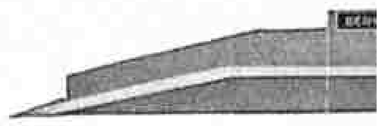
Write to Meccano Ltd., Dept. DF, Binns Road, Liverpool 13, for a free copy of the special folder giving details and prices of the complete Hornby-Dublo range.

SIGNAL CABIN DI
A typical example in wood of a medium-sized Signal Cabin. Supplied with four gummed slips printed with the names "Berwick," "Penrith," "Truro" and "Ashford." Price **11d.**

A selection of



BUFFER STOP DI
A particularly realistic model of a type to be seen in the sidings in most goods yards. Price **10d.**

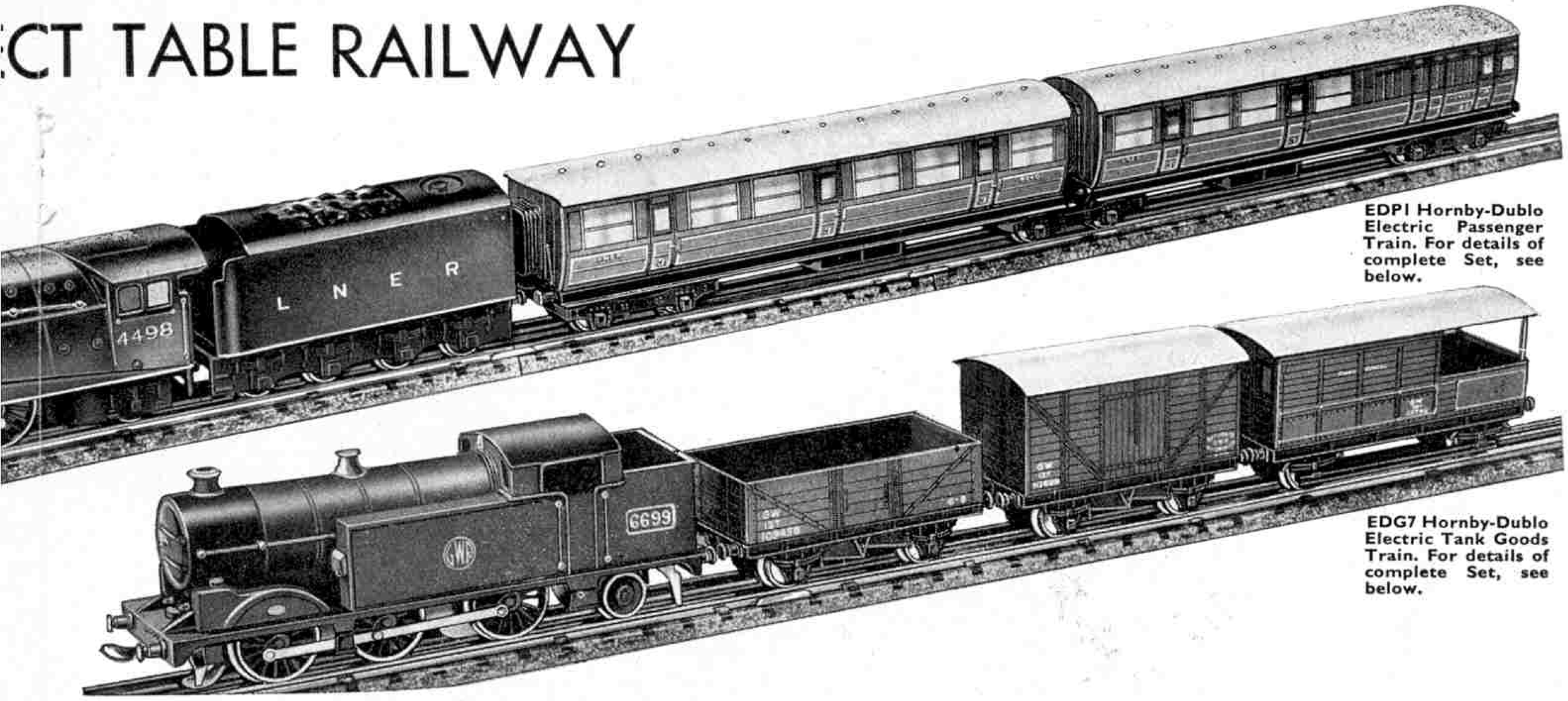


A particularly fine mode train, and is supplied with (L.M.S.), "Truro" (G.W.R.

MANUFACTURED BY MECCANO LTD

UBLO TRAINS

CT TABLE RAILWAY



EDP1 Hornby-Dublo Electric Passenger Train. For details of complete Set, see below.

EDG7 Hornby-Dublo Electric Tank Goods Train. For details of complete Set, see below.

HORNBY-DUBLO EDP1 ELECTRIC AND DP1 CLOCKWORK PASSENGER TRAIN SETS

ELECTRIC

EDP1 Hornby-Dublo Electric Passenger Train Set, L.N.E.R. Contains EDL1 Streamlined Six-coupled Locomotive **"Sir Nigel Gresley"** (Automatic Reversing), Tender D1, Two-Coach Articulated Unit D2, Dublo Controller No. 1, seven EDA Curved Rails, one EDAT Curved Terminal Rail and two EDB Straight Rails. (To be run from Dublo Transformers No. 1 or No. 2, not included in Set.) Price **70/-**

Dublo Transformers are specially designed for these Trains; no others should be used.

Where the mains supply is D.C., or there is no supply, the above Set is available with Dublo Controller No. 1a (for use with 12-volt accumulators) as follows:

EDPA1 Electric Passenger Train Set, L.N.E.R. (With Dublo Controller No. 1a.) Price **61/6**

CLOCKWORK

DP1 Clockwork Passenger Train Set, L.N.E.R. Contains DL1 Streamlined Six-coupled Locomotive **"Sir Nigel Gresley"** (Reversing), Tender D1, Two-Coach Articulated Unit D2, eight DA Curved Rails and two DB Straight Rails. Price **39/6**

HORNBY-DUBLO EDG7 ELECTRIC AND DG7 CLOCKWORK TANK GOODS TRAIN SETS

ELECTRIC

EDG7 Electric Tank Goods Train Set, L.M.S., L.N.E.R., G.W.R. or S.R. Contains EDL7 Six-coupled Tank Locomotive (Automatic Reversing), Open Goods Wagon D1, Goods Van D1, Goods Brake Van D1, Dublo Controller No. 1, seven EDA Curved Rails, one EDAT Curved Terminal Rail and two EDB Straight Rails. (To be run from Dublo Transformers No. 1 or No. 2, not included in Set.) Price **55/-**

Dublo Transformers are specially designed for these Trains; no others should be used.

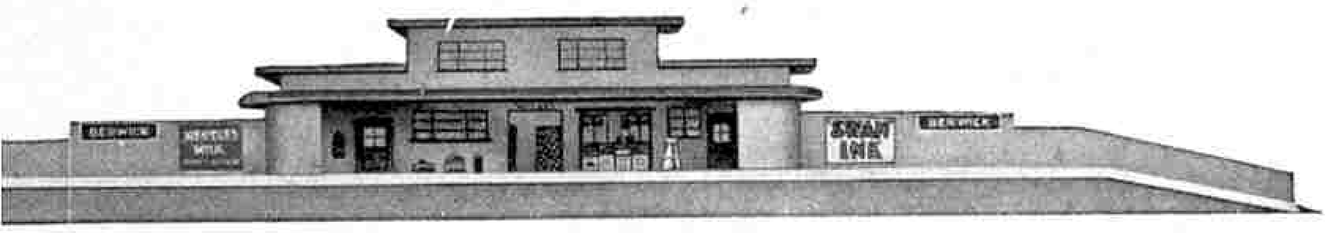
Where the mains supply is D.C., or there is no supply, the above Set is available with Dublo Controller No. 1a (for use with 12-volt accumulators) as follows:

EDGA7 Electric Tank Goods Train Set. (With Dublo Controller No. 1a.) Price **46/6**

CLOCKWORK

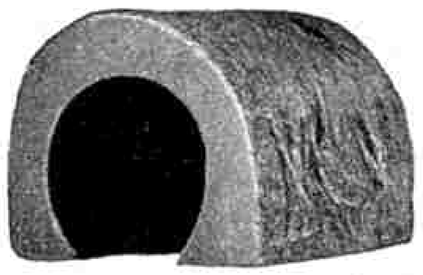
DG7 Clockwork Tank Goods Train Set, L.M.S., L.N.E.R., G.W.R. or S.R. Contains DL7 Six-coupled Tank Locomotive (Reversing), Open Goods Wagon D1, Goods Van D1, Goods Brake Van D1, eight DA Curved Rails, and two DB Straight Rails. Price **27/6**

of Hornby-Dublo Accessories



MAIN LINE STATION D1

fine model in wood of a modern-style station. It is long enough to accommodate a three-coach lied with printed gummed slips giving a choice of four names—"Berwick" (L.N.E.R.), "Penrith" ' (G.W.R.) and "Ashford" (S.R.). Size: Length 24 in., width 4⅛ in., height 3⅝ in. Price **7/6**



TUNNEL D1 (SHORT)

This Tunnel is 5½ ins. long and is suitable for either curved or straight track. Price **1/3**

Upper-Quadrant Signals

Signal D1 Single Arm "Home" (as illustrated) or "Distant." Price **1/-**

Signal D2 Double Arm "Home" and "Distant." Price **1/4**

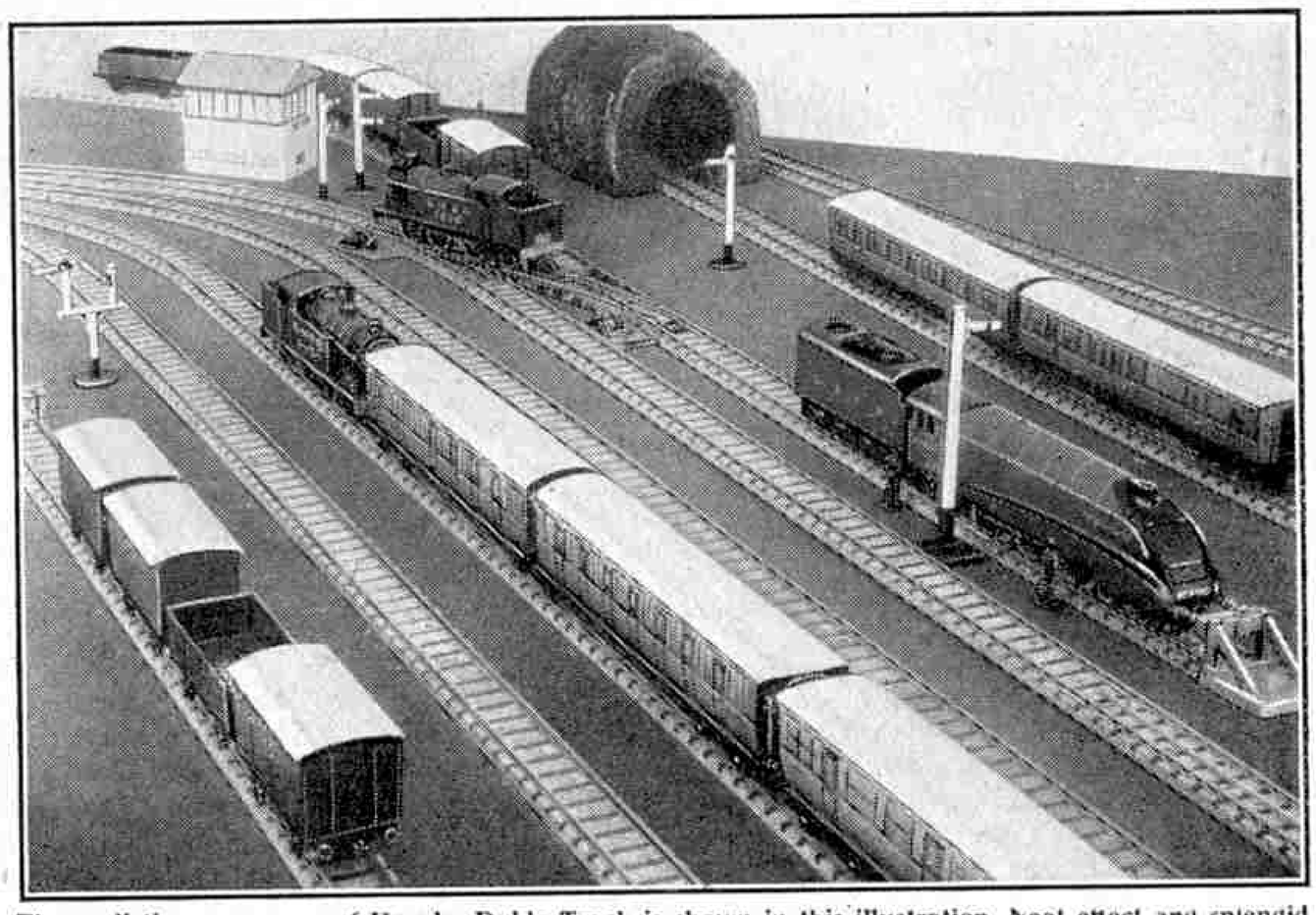
LTD. — BINNS ROAD — LIVERPOOL 13

Track for Hornby-Dublo Trains

How to Develop Realistic Layouts

THE first requirement of a miniature railway system is a strong and realistic track, of a design that allows good layouts to be developed and of accurate construction to afford smooth and speedy running. The track provided in the Hornby-Dublo Railway system meets these requirements, and has other special qualities that make it the perfect track for running Hornby-Dublo Trains, both electric and clockwork. In this article we review these various features, and show how they render possible the development of interesting and railway-like systems.

Hornby-Dublo track consists of solid drawn brass running rails of neat and realistic section. These ensure good electrical contact for electric trains, and their truth and smoothness help materially to obtain the perfect running characteristic of Hornby-Dublo Locomotives, both electric and clockwork, and of the associated rolling stock. The actual rails are mounted on a pressed metal base that reproduces exactly the appearance of the well-ballasted road bed of real practice. The neat result that is secured by this method of construction is well shown in the accompanying photographs. The "sleepers" that form part of the tinprinted design of the base are uniformly spaced and thus give exactly the close-pitched appearance of the full-size timbers.



The realistic appearance of Hornby-Dublo Track is shown in this illustration. Neat effect and splendid running qualities are features of this ideal "permanent way" for Hornby-Dublo Trains.

A point that is of special importance where the railway forms a temporary layout on a table is that the lower edges of the base of each section are turned over so that the danger of marking or scratching the table is remote. Those who require to screw their rails down to a baseboard for a permanent system can easily do so, for the base of each piece is provided with holes for this purpose. This saves time in assembly, and also does away with the risk of distorting or spoiling the appearance of the track by punching or drilling the sections at home.

The running rails are kept in alignment at the joints by miniature fishplates attached to alternate rails so that the track sections can be joined up whichever way round they happen to be put together. Similarly it is easy to form reverse curves on layouts that require them. The fishplates are anchored to the base of the rails, to which they are attached so that they cannot fall off and get lost, or stay fixed on the wrong rail when the track is being taken up. Further security is obtained by the use of special spring clips fitted at each end of every rail section. These interlock in such a manner that individual rail sections cannot come apart when they are assembled in a layout; and yet the parting of the pieces can be performed without difficulty when required. The "Permanent Way Department" on a Hornby-Dublo railway in fact have an easy time, for there is no danger of "the road" opening and leaving a gap which will derail the next train that comes along!

The spring clips just referred to also serve a special purpose on Hornby-Dublo electric layouts, for they are connected to the centre rail and provide an efficient and reliable means of securing good electric contact between adjacent rail sections. The centre rail itself, which is insulated from the metal base and from the running rails, has no fishplate. It is formed of steel and makes a perfect contact for the collector shoes of Hornby-Dublo Electric Locomotives. The centre rail is arranged on the "all-level" system, and is strongly mounted on special insulating pieces.

As far as the making up of layouts is concerned there is no difference in geometrical design between the Hornby-Dublo Rails for electric and for clockwork layouts. The only difference that occurs is that in electric layouts one of the curves must be the special EDAT Curved Terminal Rail, which is provided with terminals by means of which the current supply from the Controller is fed to the track. Layouts consisting of two electrically separate tracks, each connected to a separate Controller, require two Terminal Rails, and so on.

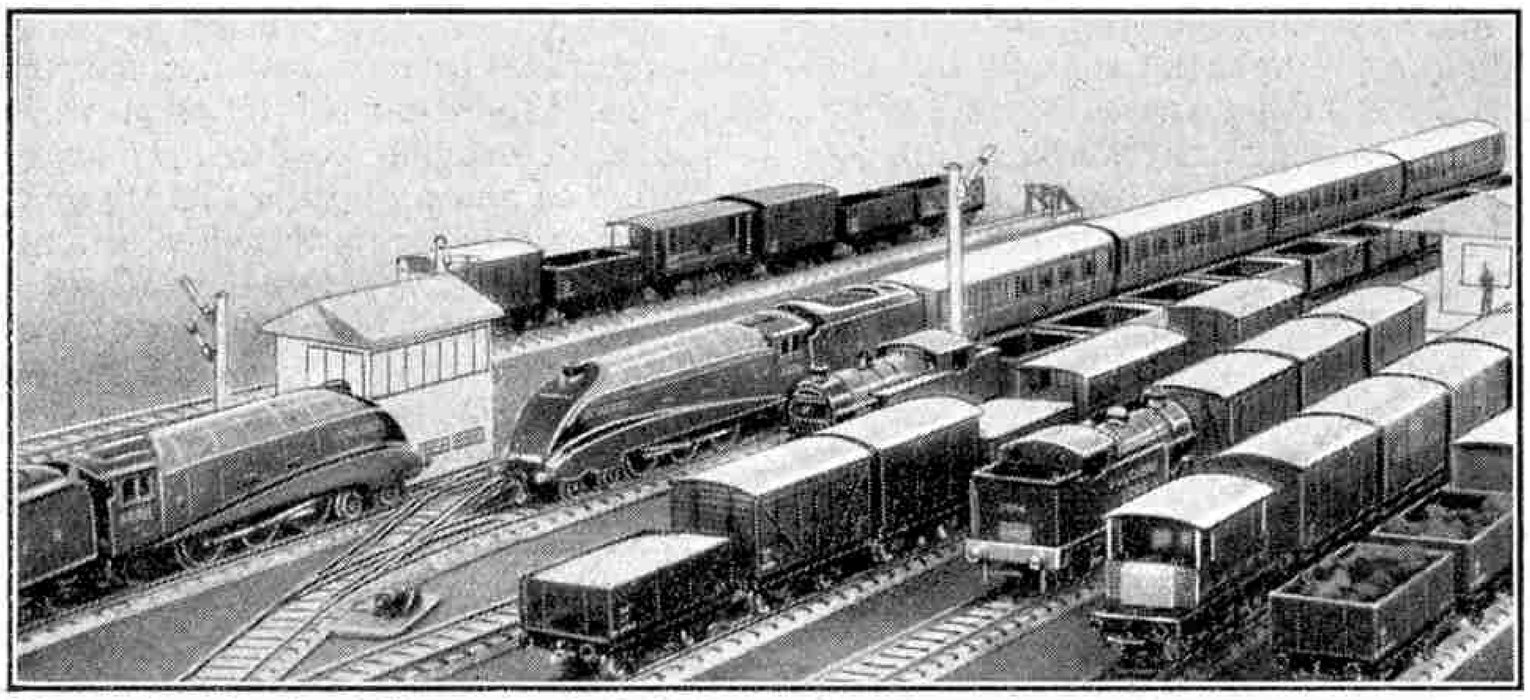
This difference in detail between the requirements for electric and clockwork layouts of similar design is shown in the lists of rails required for the different formations given in the special folder "*Suggestions for Hornby-Dublo Rail Layouts*" that has been prepared. No owner of a Hornby-Dublo Train Set should be without a copy, which can be obtained free from any Meccano dealer.

The main components of Hornby-Dublo track are Curved Rails, Straight Rails and Points. The standard radius adopted for the Curved Rails and for the curved arms of the Points is 15 in., measured from the centre of the circle to the centre line of the track. A space having a minimum width of 2 ft. 10 in. is therefore necessary for a Hornby-Dublo layout in order to allow a sufficient margin

outside the track for safe running and good appearance.

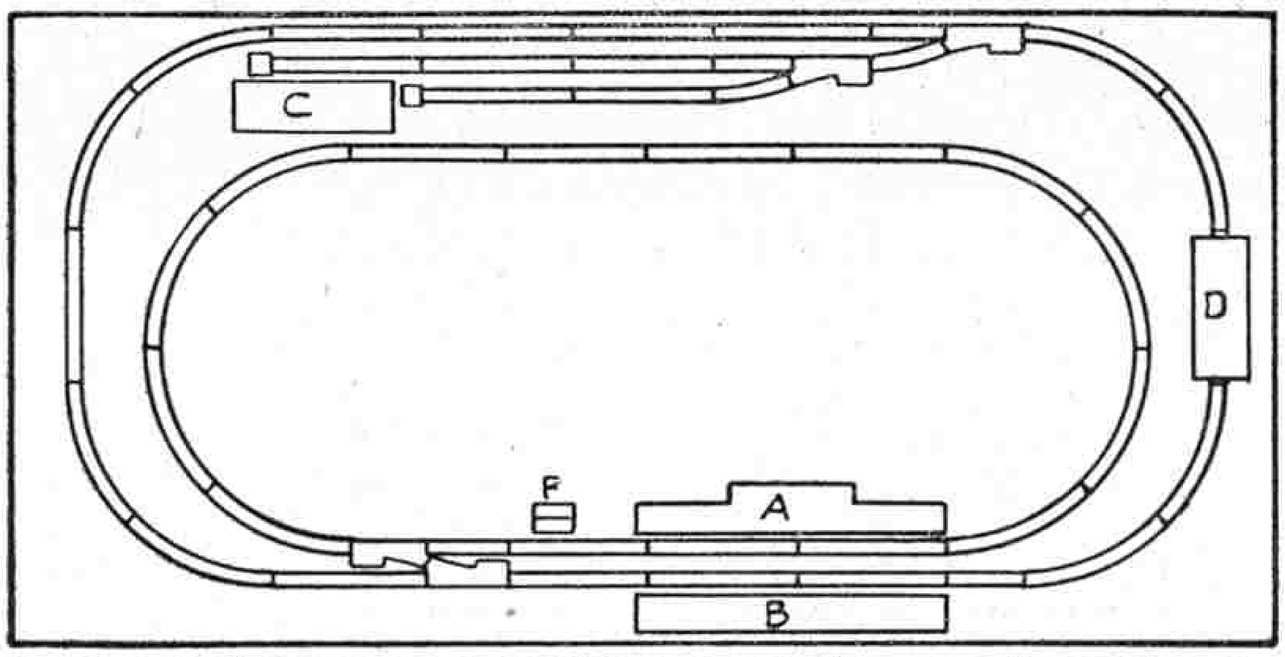
A complete circle is formed by eight of the Curved Rails, so that half-circles and quarter-circles are easily made up. This is a great convenience when it is required to form a large oval track, for straight lengths can be led off from the half- or quarter-circles at the ends of the layout. Curved Half Rails also are made, and these fulfil a useful purpose that is referred to later.

The standard Straight Rails are 11½ in. long; this comparatively great length means a minimum of rail joints in a given layout and helps the smooth running of the trains. Straight Half Rails too are provided which are necessary in making up loop lines and sidings. There is also a Short Rail; this is a straight rail of special length which is inserted in the straight sides when there is a "return loop" formed by a reverse or "S" curve connecting points situated on these two sides. Its particular function is shown in one of the layouts contained in the "*Hornby-Dublo Rail Formations*" folder.



A busy goods yard and main line on a Hornby-Dublo layout. Points are prominent in the left foreground. They form a connection between the up and down main lines on which two expresses are passing.

Hornby-Dublo Points are particularly interesting in design, and are perfect in every way. The arrangement of the switch rails, and of the fixed rails and crossing elements, follows real practice very closely. The Points are of the ordinary turnout kind, and are made in two patterns, right hand and left hand. The solid base which is used in the construction of these ensures perfect rigidity and alignment of all parts and is uniform in design with the bases of the other Rails.



A specimen layout from the special folder "Hornby-Dublo Rail Formations," referred to in this article. The letters refer to various Hornby-Dublo Accessories as follows: A. Main Line Station; B. Island Platform; C. Goods Depot; D. Tunnel (Long); F. Signal Cabin.

At the crossing of the Points where the actual routes diverge, the "V"-shaped Frog and the rails alongside it forming the wing rails are combined in one die-cast unit. This makes it impossible for the various components of the crossing to get out of alignment. Check rails are fitted close to the running rails opposite each side of the frog as on real points. They ensure a smooth and easy passage for the trains whether they take the straight or the curved route.

The layout diagram reproduced on this page shows very well the relation between the various track components. Double track rails are not yet included in the Hornby-Dublo range, but quite satisfactory double track main lines can be made up of two single tracks. In order to make possible perfectly systematical layouts, however, special large radius curved rails will be introduced later. In conjunction with the Curved Rails now available, these will form perfectly parallel double track curves with a standard "6 ft. way" separating them.

The Points have a definite relation to the Curves and to the Straight Rails. The straight portion of a set of Points is equal in length to a Straight Half Rail, and the curved portion also corresponds in length and radius to a Curved Half Rail. An interesting feature is that when two right hand or two left hand Points are used together on adjacent tracks, they form right hand or left hand single crossovers, in which the distance apart of the straight tracks forms the standard "6 ft. way" adopted for Hornby-Dublo Rails. The levers of the Points are arranged inside the curve, but they are so designed that they fit perfectly between the tracks without fouling trains on either line.

Siding and loop lines therefore can be arranged readily by means of the new Points. The manner in which this is done is illustrated by the accompanying diagram, which shows a specimen layout from the folder previously referred to. A curved Half Rail added to the curved turnout of the Points, thus forming a reverse curve, brings the diverging track parallel to the main track. The insertion of a Straight Half Rail in the Straight track beyond the end of the points then causes the rail joints of the parallel tracks to come opposite each other. This is a great convenience when Buffer Stops are to be arranged at the end of siding roads, as it allows a neat and tidy arrangement to be obtained.

The layout shown in the diagram is a good example of what can be done with Hornby-Dublo Rails in a space 8 ft. by 4 ft. The system can be arranged equally well for electric or clockwork trains and consists of two main tracks. These two tracks are connected by Points that are used to make up a crossover. The two main lines can be used in the orthodox manner for up and down trains or independently for traffic in either direction.

Goods sidings are situated between the inner and outer main tracks, and they make possible the performance of interesting shunting and marshalling operations. Each siding road is terminated by Hornby-Dublo Buffer Stops.

Suggested positions for various Hornby-Dublo Accessories are shown in the diagram. The inner main track is served by the Main Line Station and opposite this, serving the outer main track, is the Island Platform. A Signal Cabin is shown near to the Main Line Station. There is a Goods Depot near the sidings, and a long Tunnel is situated on the outer main line.

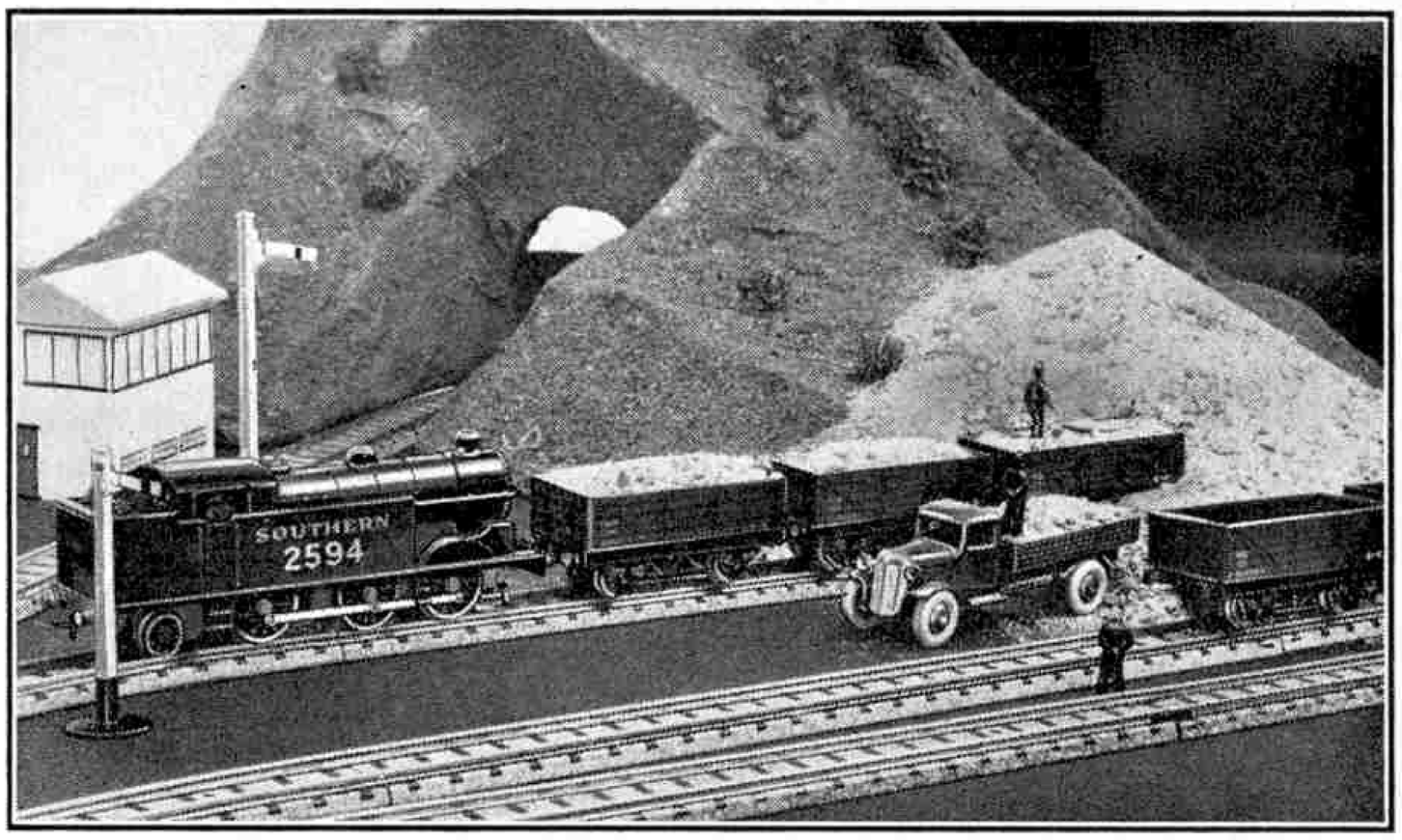
Loads for Hornby-Dublo Goods Trains

Fun with Miniature Freights

ONE of the first instincts of the model railway owner is to provide actual loads for his goods wagons to carry. The wagons themselves may be realistic enough, but the railway will never pay its way if they are run about empty all the time! Finding and making up suitable loads for Hornby-Dublo goods trains is great fun. Goods and materials of many kinds can be placed in the Open Wagons D1, but the Covered Vans naturally cannot be loaded up. Loads that would be carried in such vans in real practice can be placed on the platform of the Goods Depot, however, where they will look as if they are ready for conveyance by train or as if they have just been unloaded.

Freight for Hornby-Dublo vehicles must be in keeping with the small size of the wagons. It also must be light, especially on a clockwork-operated line, and on Hornby-Dublo railways that are of the table-top character it must be clean and of a "tidy" kind.

Probably the first material that will suggest itself as a load is the Hornby Coal. Although this is somewhat large it has the right "coaly" appearance, and is both light and clean. Several Open Wagons loaded with it can form part of a mixed goods train. Alternatively the running of a complete train of Coal can be a regular feature of operations, and will imitate the operation of the real coal trains that are such a prominent feature of the heavy freight traffic on British railways.



A realistic scene on a Hornby-Dublo layout, showing a "quarry" served by the railway. The "stone" is actually coarse sand that is loaded in the Open Wagons in the manner described on this page.

In order to give variety to the traffic on Hornby-Dublo layouts various kinds of what we may term "prepared" loads can be devised by enthusiastic "Goods Managers." A convenient method of arranging such loads is to prepare a series of cardboard "load supports" shaped like box lids to fit into the wagon bodies. The tops of these should come very near the top of the wagon, and their upper surfaces should be coated with glue or Seccotine, on which a layer of the material selected should be allowed to set in position. Hornby Coal can be carried in this way if preferred; it will save the loading of individual Wagons each time a coal train is required to be run.

Rice can be used to represent granite or limestone, and coarse sand also gives a realistic appearance. Dried peas are another household commodity that can be employed quite well. A selection of different "loads" can be made up and kept in a box reserved for the purpose. Here they will not be liable to damage, and particles of the different substances will not be shed on to the line or the surrounding premises.

Another load that can be prepared makes use of dead matchsticks to represent a consignment of sawn timber beams. When carried in open wagons these are often loaded in a sloping position, the lowest layer of the beams resting on and projecting slightly over the wagon end. The easiest way to secure this effect is first to cut a rectangle of cardboard of the internal width of the wagon and long enough to stretch from the floor at one end, up to the top of the other end, and then vertically down to the floor again when bent to shape. This forms a sloping platform of just the right height on which to support the wood. For this a number of matchsticks should be trimmed to equal lengths. The first layer of the load is then stuck lengthways on the cardboard support, the match sticks, or "beams" as they now are, projecting just about an eighth of an inch beyond the high end. When these have set another layer can be stuck on with the outer ends of the beams further in than those of the first lot, and this can be continued until several layers have been fixed, with the inner ends of the last lot touching the end of the wagon towards which the load slopes down. If this is carefully done the finished load is most realistic.

Much can be done by the ingenious owner of a Hornby-Dublo railway with various odds and ends that can be found at home. Small round tins or even pill boxes can be made to look like cable drums. Cubes or rectangular blocks of wood can be sawn, and painted if necessary, to represent large blocks of stone. All these form suitable loads for the Open Wagons.

For use on the platform, as loads supposedly conveyed by the Covered Vans, small corks can be trimmed to look like casks or kegs. Pieces of plain wood can be cut to various sizes to look like cases of different kinds. They can be marked with pencil lines imitating the boards making up the cases, and can be decorated with ink letters and signs representing traders' marks and so on. Some of these can be tied with thread as if roped up. It is possible too to construct miniature crates of match sticks, but this task requires considerable patience. Each side of a "crate" should be assembled separately, after which the sides can be stuck together. Before the last side is secured, however, the "crate" should be stuffed with tissue paper to represent the packing of some article.

Learning to Build Engines at Swindon

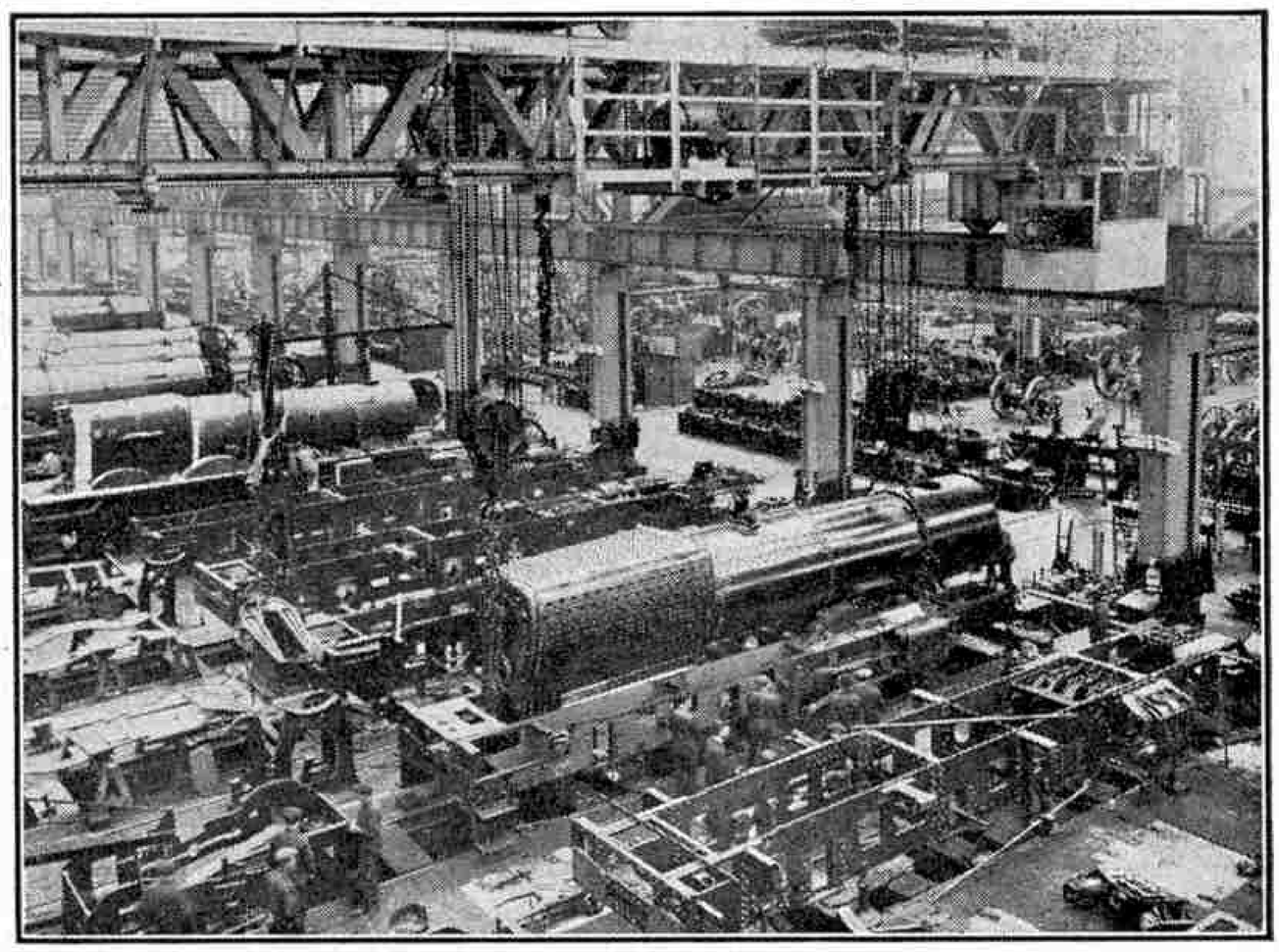
How Railway Apprentices are Taught

By F. G. Richens

SCIENTIFIC planning is to-day the accepted principle in every branch of industry. This holds good in the workshops of Britain's main line railways, and applies not only to the building of the actual engines and rolling stock, but also to the training of the engineers of the future. One of the first training schemes to be developed was that at the Swindon works of the G.W.R. This system of control and planning, which forms the subject of this article, ensures that every lad who enters the engineering workshops there passes out well equipped in every branch of the trade.

Boys should be 16 years old when they start work, but exceptions are made in the case of those from secondary and public schools who cannot be released until they are older. Engine construction is not only highly-skilled but also arduous work, and the company insist that every accepted candidate shall have reached a good educational standard, and shall have been certified as physically fit by the company's own doctor. Even then a probationary period of one month is served, usually in one of the fitting shops, before a lad is definitely apprenticed.

Modern methods of locomotive building call for a considerable degree of sectionalisation. A system is in force at Swindon, under which the manufacture of the many components of an engine is allotted a standard time for completion, the various components being so routed that they automatically arrive together at the erecting shop without fuss or delay. The training of an apprentice must fit closely into this system if he is to have experience on all stages of the work. The number of apprentices who can be accommodated in each shop, and the period that can be given on each type of work, are dependent on the facilities and volume of work available. The training scheme also has to provide an even flow of lads to avoid upsetting the balance of the different gangs.



The erecting shop at the G.W.R. Swindon works, showing several locomotives of the "King" class in course of erection. Photograph by courtesy of the G.W.R.

The apprentice must start his training on fairly light work of a simple nature. Heavy and difficult jobs must be left until towards the end of his five years' training, when his strength and skill are equal to them. Broadly speaking, these varying requirements have been fitted into a scheme that sends the lad on approximately the same path through the works to the erecting shop as is followed by the various parts of the engines he is learning to build.

The work of an apprentice falls naturally into three main divisions—turning, fitting and erecting. The jobs in each division have been sub-divided into groups in such a way that a lad who serves the allotted time in each of a specified combination of groups will receive a good, all-round experience of the trade. The wide range of work involved in engine construction makes it possible to adjust the training to the capabilities and needs of any particular apprentice.

The first two years of training is spent on turning and general machine work. Every boy begins in the first machine group, where he does such simple repetition work as nuts and bolts. The six months he spends on this work give him an opportunity of becoming accustomed to the workshop atmosphere, and at the end of it the schoolboy has been converted into the engineering apprentice.

In the second group, the work probably will consist of machining engine parts from the foundry, forge or stores, and the learner has excellent experience on such machines as turret, cupping, centre, vertical boring, and combination turret lathes. Those lads who show particular promise may be selected for experience in the machine tool or millwrighting shops.

Two years may seem a long time to be engaged on machine work. This is a period of great importance in the training, however, and in it an apprentice should gain a sound knowledge of the different machines and their varying capabilities, as well as an insight into the principles underlying many engine parts.

The next phase of the training occupies eighteen months and is carried out in the fitting shops, where the apprentice works on those parts of an engine that need preliminary fitting before they pass to the erecting shop for assembly. Here again there is the same progress from the least to the most difficult types of work. There are three main fitting groups in the standard training, and they include work on axleboxes, brake gear, eccentric straps and sheaves, and coupling and connecting rods. The wide variety of work available in the fitting section is shown by the fact that there are eight special groups. Experience in these groups, which cover the brass, millwrighting, boiler mounting and machine tool shops, is given to the lads showing the best records in the works and at technical classes.

When the apprentice transfers to the erecting shop for his final spell he should have mastered the intricacies of the various engine parts and should understand their function in the operation of the engine. In the erecting shop he learns how to build up the finished engine from the many components on which he has been working. Erecting is the heaviest and most important part of the trade, and the three and a half years already spent in training have developed the strength and skill to tackle it successfully. The apprentice works through the erecting shop and learns each process, from the initial work on the frame to the fitting of boiler and wheels, the erection of rods, springs, crossheads, pistons and valves, and the running-in of the bogie.

The operation of the training scheme is controlled from the office of the works manager. Here control sheets show, on the one side, how many lads can be accommodated on each type of work; and on the other, the actual work on which each boy is engaged. The key to the training is the report card that follows every apprentice round the shops. On it are posted particulars of the work on which he has had experience, and a report from each of his supervisors as to character, ability and timekeeping. The details are completed by progress reports on technical class achievements.

Special attention is given to the question of technical training. The classes progress with the work in the shops, and are designed to give a sound theoretical knowledge of the trade. The staff at the local technical college, where the classes are held, is strengthened by specialist lecturers drawn from the technical and administrative side of the works. Every apprentice has the opportunity to compete for day studentships, which are awarded on the results of the examination held at the close of each session. The lads who distinguish themselves at the day classes are usually given a period of training in the drawing office or laboratory, always provided that their workshop record is satisfactory.

At the end of his training, an apprentice should have a thorough knowledge of the principles on which an engine works, and of the methods employed in building it.

Mountaineering in Britain

Fell Walking and Rock Climbing

By Sydney Moorhouse, F.R.G.S.

OF all outdoor sports, there is none that combines health-giving qualities with sheer enjoyment more thoroughly than does mountaineering. Easy rambling through the fields and woodlands and along the downland paths is all very well in its way, but many of those who are healthy in mind and body prefer something more energetic. The breasting of the long slopes, the lashing of the strong mountain wind on the face, and the final thrill when one reaches the summit cairn and surveys all the lands around spread out in map-like perfection below are sensations that only the mountaineer can know and enjoy.

It is only within comparatively recent years that mountaineering has become really popular in Britain, for previously it was imagined that it was necessary to go abroad to the Alps, the Dolomites or other high places of the Continent in order to indulge in its pleasures. The development of better transport facilities, the provision of cheaper and more comfortable accommodation, the increase of interest in camping, and above all, the advent of the youth hostel movement, have all combined in late years to place our British mountain districts of Snowdonia, the English Lakeland, the Highlands of Scotland and Skye on the mountaineering map. Granted that our British mountains are small compared with those in Switzerland, Spain or Austria, but mere height is not the sole concern of the climber. Many of the peaks of Snowdonia and the Lake District rise abruptly from sea level, and their gradients are so steep that they provide real climbing thrills, making up in difficulty for what they lack in actual altitude.

Tricky work on the almost vertical rock face on Kern Knotts Crack, in the Lake District. Very delicate movement and perfect balance are necessary for this climb. Photographs by Tom C. Stephenson.

The modern tendency to restrict the use of the term mountaineering to rock climbing is to be deplored, for, strictly speaking, the word refers to almost every possible form of sport on the hills, fell walking, rock climbing, Alpine climbing and even cave exploring coming within its category.

So far as real Alpine climbing is concerned British mountaineers are at a disadvantage, although similar conditions to those appertaining in the Alps can be found among the great bens of Scotland at Easter and in the earlier months of the year, but the other aspects of the sport can be indulged in all the year round in our own country. Fell walking and rock climbing are the two favourite forms. The first is concerned with reaching the summit by devious routes, and making one's way along the various ridges that form such a conspicuous part of our British high levels. The rock climber, on the other hand, is chiefly interested in finding routes up the faces of the crags themselves rather than making for the actual tops. Indeed, I have met rock climbers who have climbed every crag and pinnacle on a mountain and yet have never seen the summit cairn!

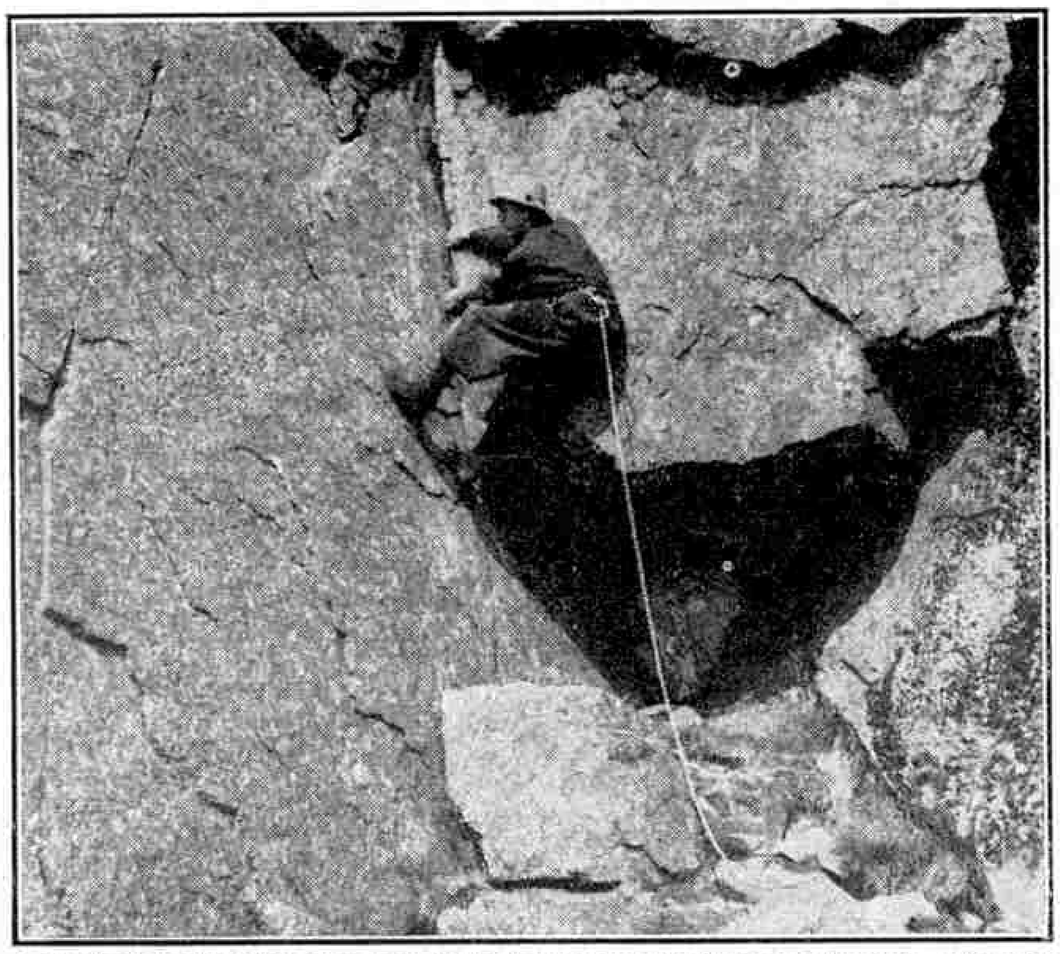
One can only become an expert rock climber after a great deal of practice and tuition, while one also needs a natural gift for balance and clear-headedness at high levels; but the thrills of fell walking are open to all. There are good tracks to the tops of the majority of our British hills, and more difficult and adventurous routes that can be tackled later when one has mastered something of mountain walking technique. Hundreds of walkers make their way up Snowdon from Llanberis every week during the summer months, and the ascent of Ben Nevis is almost as popular. Scafell Pike, on the other hand, comes at the end of a long climb from either Wastdale, Borrowdale or Langdale, and consequently is not quite so much frequented.

The first requisite of the mountain walker is good footwear. Boots are to be recommended for the majority of the mountains in North Wales, Scotland and the wilder parts of the Lake District, although I have traversed the ridges to the east ot the Lake Country and those of the High Pennines in stout shoes. See that the boots or shoes are big enough to take an extra pair of stockings, as these will prevent small pieces of stone and scree from working their way into the uppers and hurting or even injuring the feet. The extra pair of course should be folded down so as to form a protective pad round the ankles. Make sure that the soles and uppers are firmly fixed together; I have seen the great sharp-edged slabs of the top of the Glyders, in North Wales, break up what seemed quite a strong pair of walking shoes.

Shorts may be worn with comfort on a hot day unless a great deal of rough scrambling is to be indulged in; in that case a pair of riding breeches or plus fours will be found more serviceable. You will carry a rucksack with some spare stockings, a raincoat—I have always found a raincoat much better than a cape on the high levels where the

wind can be both strong and troublesome—sufficient food for the day, a scarf, which should be put on when you stop to eat, and of course both map and compass. The two last-mentioned objects are really necessary and should be consulted regularly, particularly on those days when sudden mists are likely to come sweeping down and the highest summits are veiled. Never wait until you have entered the mists before taking stock of your position, or you may have a hectic time when the landmarks are hidden. Nine out of every ten cases of walkers being lost on the uplands are due to this simple precaution being neglected.

Always keep well within your own powers, and try to avoid having to negotiate any really tricky bits of rock and awkward descents too late in the day. The mountain climber is much more prone to have an accident or a nasty fall towards the end of the day, when stamina is at its lowest ebb.

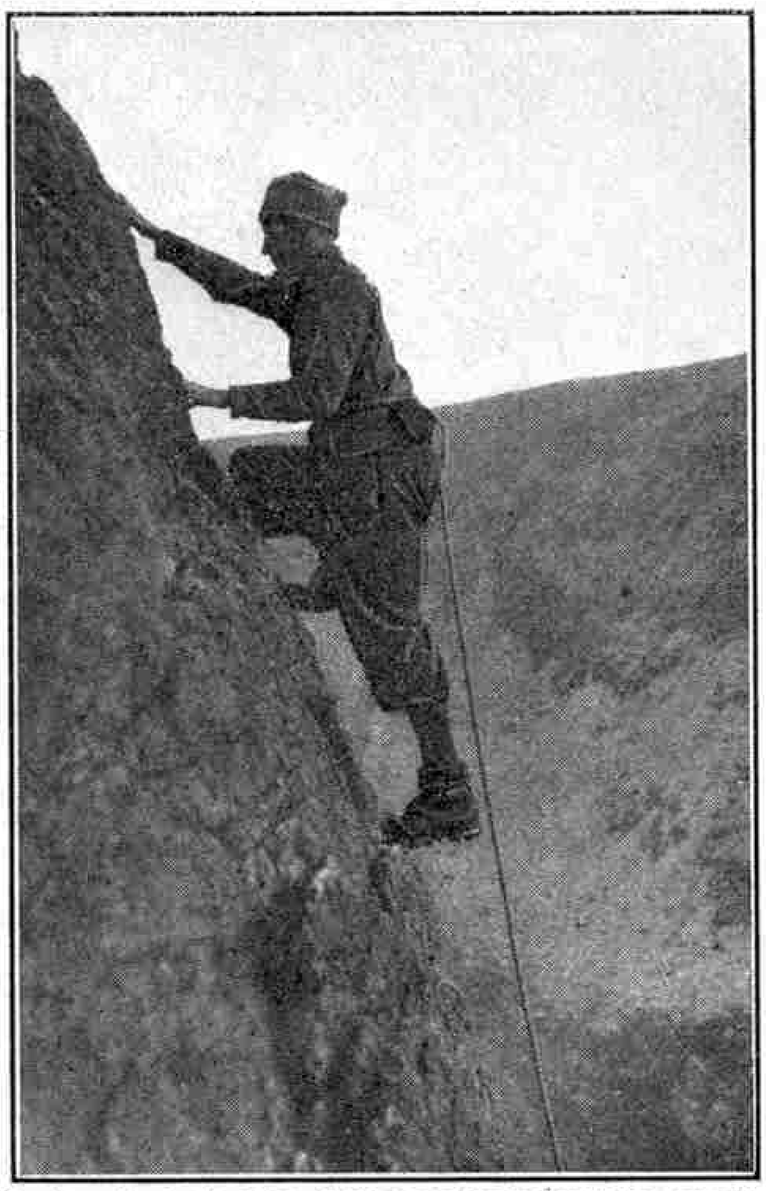


A climber working his way upward by holding with his hands along the edge of a crack and opposing the pull of his arms to the pressure of his feet. This movement, known to rock climbers as a "lay-back" is very exhausting.

A few seasons' experience on the mountain tracks and ridges is the best apprenticeship for rock climbing, which is the hardest type of mountaineering that can be practised regularly in Britain, and requires special training in addition to knowledge of mountain craft. The inexperienced can learn many of the rudiments of ordinary mountain-tramping from his own experiences, but the only way in which to learn the first stages of rock climbing is in the presence of a practised climber. To venture out on a group of rocks either alone, or with a party of inexperienced friends, is to court disaster.

A good teacher therefore is a first essential, and those who can get in touch with members of a first-class climbing club can perhaps arrange to have one or two instruction climbs in their company. On the other hand, those less fortunate need not despair, for there are now professional guides available in the Lake District, and these are always willing to teach novices the foundations of good climbing.

Perhaps the real secret of successful climbing is in learning how to balance oneself with the feet, and not with the hands and arms. The accomplished dancer, who has learned the art of moving easily about the ballroom floor without treading on his partners' toes, usually starts with a good advantage.



On Dow Crags, Coniston. This photograph shows the narrow ledges that are used as footholds.

It is obvious that a great deal depends upon the climber's footwear and, as in the case of the ordinary fell walker, a good pair of boots should be purchased at the outset of one's rock-climbing career. These should be made of a soft supple leather and have a sole about an inch in thickness nailed in one of the many approved varieties of nailing. Only a few firms in this country specialise in the making of climbing boots, and as the rock climber's life may depend upon the quality of the nailing, it is essential that boots by one of these should be chosen.

The remainder of the clothing can be left to the climber's discretion, although of course shorts are quite unsuitable and a suit made of windproof material is always an advantage.

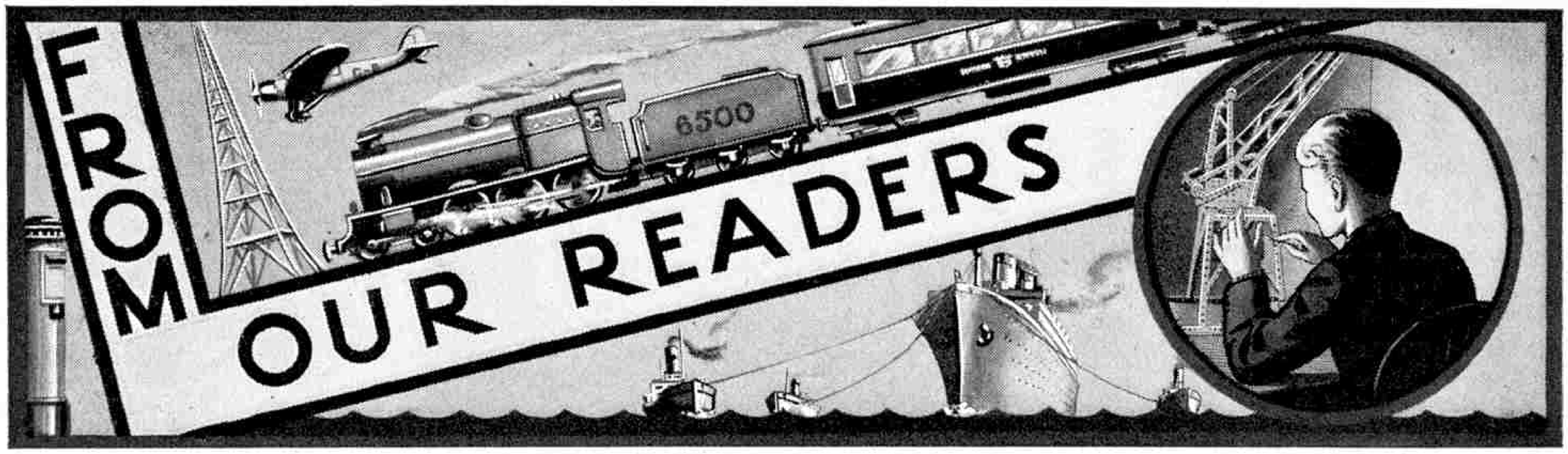
Careful use of the rope plays a great part in rock-climbing, and far too many non-climbers have a hazy idea of the part played by this important piece of the cragman's equipment. Its chief function is to ensure safety, and it is never used, as I have heard people suggest, for hauling up lighter members of the party or for swarming up and down a cliff-face.

It is not likely that the rock climber will be called upon to purchase a rope of his own during his first season on the crags, but when one is purchased it should be a cotton or hemp line at least an inch in diameter, although a thinner rope may prove serviceable if its quality is guaranteed by a reliable firm of ropemakers.

When a crag is being climbed the rope is used in a definite manner, and some idea of this must be mastered by every climber before he ventures on to the rocks. The members of a party are roped together at intervals of ten or fourteen feet, and it is essential that proper rock-climbing knots be used, or there will be a danger of strangulation or broken limbs as the climb proceeds. Any Boy Scout will show the prospective climber how to make a bowline and middleman's knot, the two types most often used.

In British climbing only one man moves at a time, and the leader commences by climbing to a spot where he can make himself safe and proceed to bring up the second man. He usually makes his own position secure by what is known as a belay, often formed by looping a section of rope round a projecting piece of rock. This done, he can concentrate on keeping the rope taut and bringing up the second man. When all the party has reached this point, the leader commences on the next stage and the procedure is repeated.

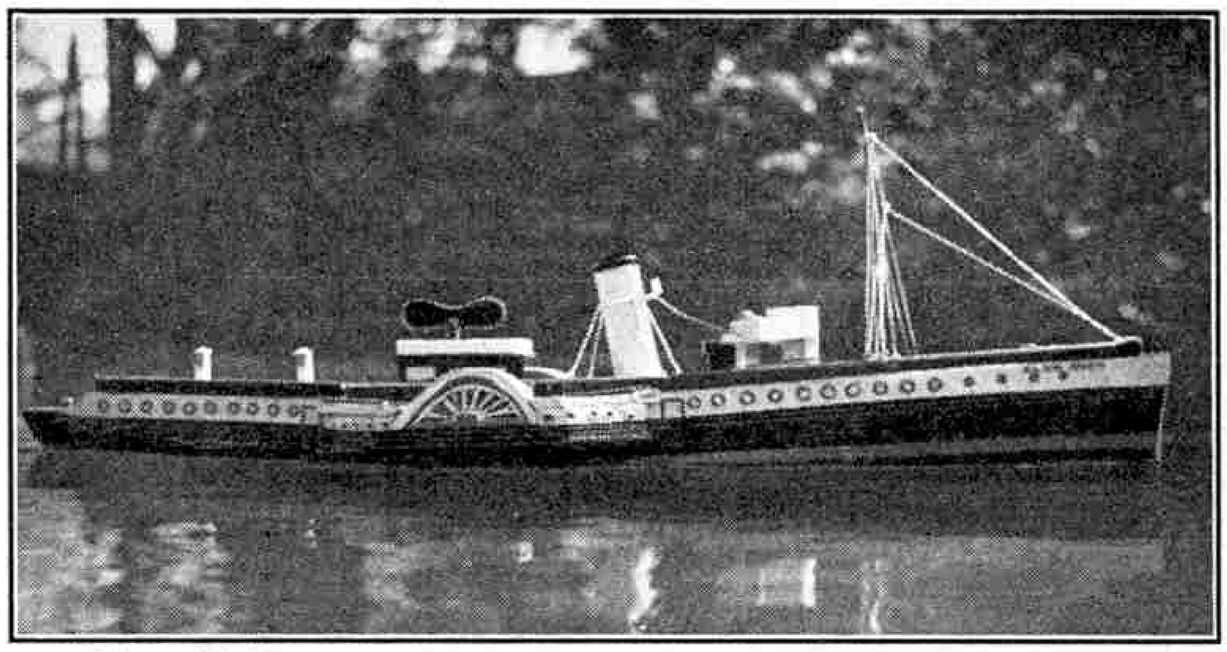
It is obvious from this that a great deal of responsibility is placed on the leader, so that position is generally reserved for one with a sound knowledge of climbing technique and with much experience of rock conditions.



These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of which the writer has special knowledge or experience. These should be written neatly on one side of the paper only, and should be accompanied if possible by original photographs for use as illustrations. Articles published will be paid for. Statements in articles submitted are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

Model Ships Driven by Meccano Motors

Visitors to the Bristol Channel and the Sussex coast will be familiar with the passenger vessels of P. and A. Campbell Ltd. These paddle steamers, with their white funnels and bright decorations, make attractive subjects for models, and the illustration on this page shows one such miniature that is driven by a Meccano No. 2 clockwork motor. This fine model represents the *"Glen Avon,"* which is employed on the Cardiff-Weston ferry and Channel cruises. It has just been returned to me for overhaul after two years' running at a holiday camp, and although bearing signs of hard going the motor and transmission are in perfect condition.



A realistic model of the paddle steamer "Glen Avon," a ferry boat plying in the Bristol Channel. Photograph by L. V. Partridge, Bristol.

Another model I have built is of the *"Glen Gower,"* which runs from Brighton and neighbouring resorts to Boulogne. This model is 32½ in. long, and the ability to drive a vessel of this size is a remarkable proof of the power of the Meccano No. 2 clockwork motor that is fitted in it. The hull is of tin on a wooden frame, and the position of the motor provides a low centre of gravity. L. V. PARTRIDGE (Bristol).

Surveying England by Night

The lower illustration on this page is a view looking vertically upward inside the 140 ft. observation tower erected at Crowborough Beacon, Sussex, by the Ordnance Survey Department. The tower is a primary point from which the angles of other stations are taken at night by observing lights on them. This work is being carried out in connection with the re-survey of England.

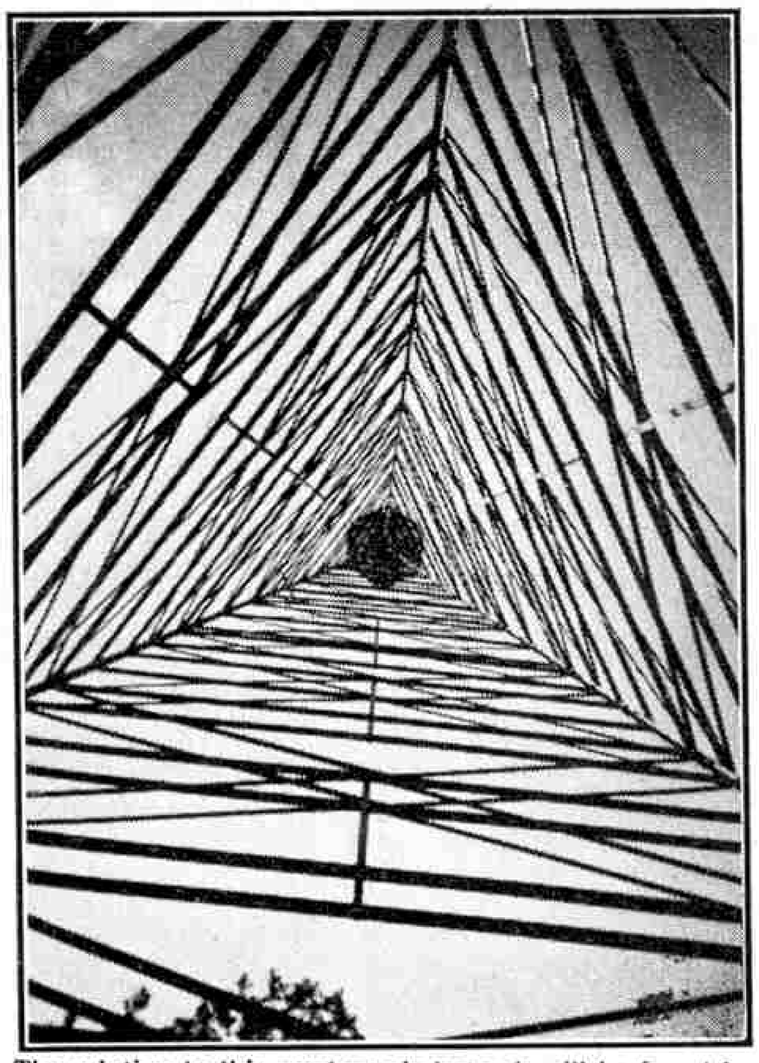
All angles are read with an instrument known as a theodolite, and the one used by the Ordnance Survey is so accurate that with it angles can be read to one second, an angle so small that 324,000 of them are required to make up a right angle.

A theodolite consists of a telescope mounted in a frame so that it can turn in a vertical plane, the frame itself rotating in a horizontal plane. The angles through which the telescope turns are read by means of scales fitted with micrometers, and known as the vertical and horizontal circles, and the position of the theodolite is transferred to the ground by means of a plumb bob. The instrument usually is mounted on a tripod, but that at Crowborough is at the top of the tower.

A survey such as this is based upon the accurate measurement of a baseline, from the ends of which the angles of surrounding stations are observed to form triangles, the lengths of the sides of which are then calculated. These sides form bases for further triangles, and so a network of "primary" triangles with sides averaging 40 miles in length is extended to cover the whole country. The primary triangles are then split up into secondary triangles with sides of 10 to 12 miles, and these again into tertiary triangles that enable the surveyor to complete his work by taking distances or "offsets" at right angles from the line to objects he wishes to mark on the map.

In the case of the Crowborough Tower the detail is to be supplied by means of aerial photography, resulting in a great saving of time. The plans are plotted to a scale of 1 in 2,500, which is about 25 in. to the mile, and the 1 in., 2 in., 3 in. and 6 in. maps are produced by reduction from the 25 in. Ordnance sheets.

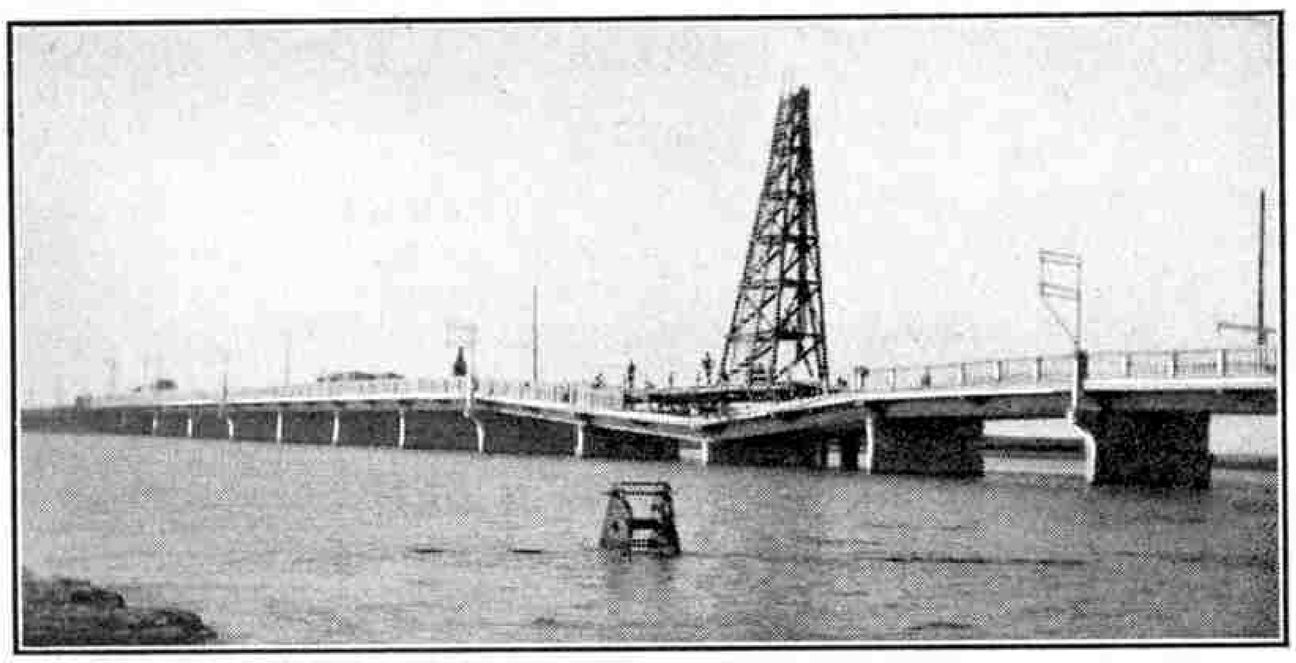
J. W. TESTER (Tunbridge Wells).



The solution to this mystery photograph will be found in the accompanying article "Surveying England by Night" by J. W. Tester, Tunbridge Wells.

Rebuilding a New Zealand Bridge

Three days of heavy rain in New Zealand last April caused floods that resulted in the partial collapse of the Waitangi Bridge, a photograph of which is reproduced on this page. The bridge is of concrete, and is on the main road between Hastings and Napier. It had been completed only a short time before the floods occurred.



Lifting part of the Waitangi concrete bridge, New Zealand, which collapsed during great floods in April last year. Photograph by E. C. Grayland, Waipukurau, New Zealand.

Swirling waters scoured away the river bed where one of the piers rested, and this caused the bridge to subside only a few minutes after a motorist had crossed over it. The collapse occurred at night, and the police had to rope off the ends of the bridge quickly and warn motorists to turn back. Large crowds of sightseers rushed to the scene, adding to the congestion.

The work of restoration is proceeding apace, and in the meantime traffic is being diverted to another but much longer route. Pedestrians are now allowed to cross the bridge, however. Motor buses bring passengers to one end of the bridge where they alight, and then cross to board another bus at the other side. Fears were felt for the safety of the railway bridge, which crosses the river close to the traffic bridge, but this escaped damage.

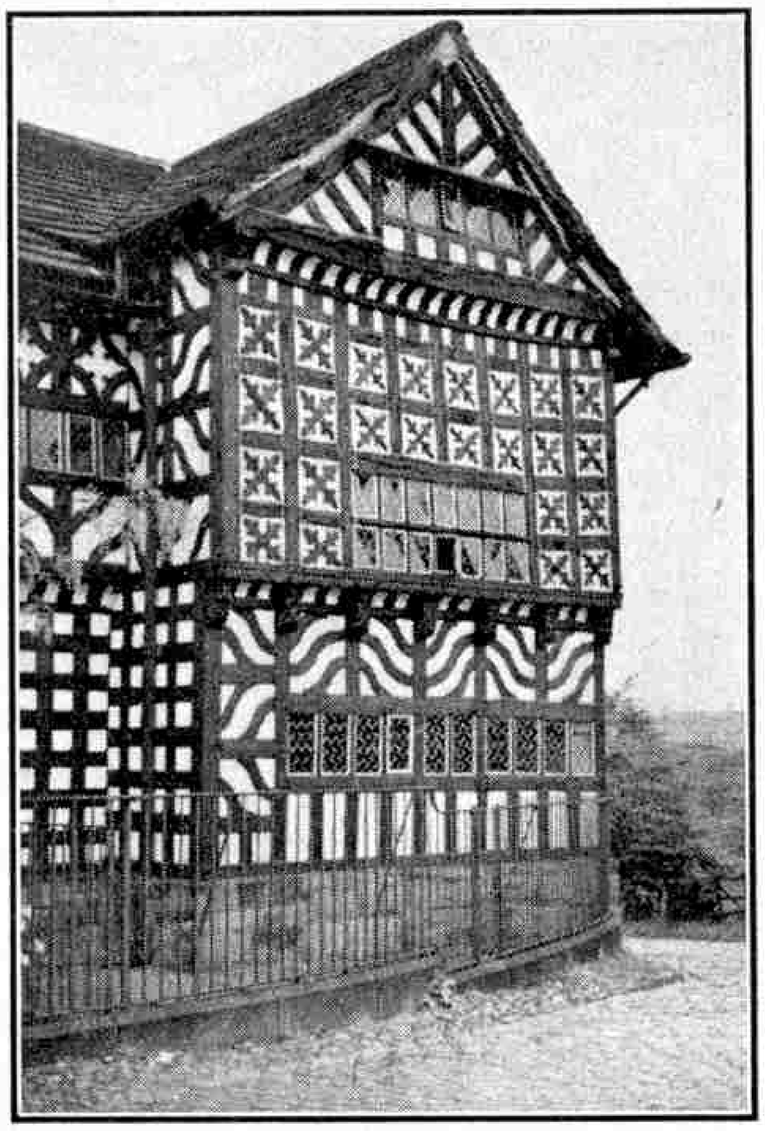
The lifting of the Waitangi Bridge presented an interesting engineering problem for the Public Works Department. The derrick shown in the photograph was erected for driving in temporary wooden piles. These huge piles are first suspended above the bridge and then slowly lowered through holes cut in the decking. When these are all in position the bridge will be raised on to them, and it will then be possible to replace the concrete piers.

E. C. Grayland (Waipukurau, N.Z.).

A Great Inventor's Home

Close to a newly-metalled highway on the outskirts of Bolton is the Hall i' th' Wood, a fine half-timbered manor house of great interest not only for its 16th century architecture, but also for its association with Samuel Crompton, the inventor of the spinning mule. Crompton went to live there in 1758, at the age of five, when his parents became caretakers of the old house, in which there are many relics of him. A little room about 6 ft. square is still pointed out as the room where he worked at the invention that later was to cause a revolution in the fine cotton industry.

When visiting the house I approached it through a narrow lane from the Darwen road. The building stands high above a little stream, and it is not difficult to visualise the wood that once surrounded it, giving it its name and supplying the oak from which its massive beams were made. I entered the hall from the stone porch, a later addition above which is Crompton's little room, and found myself back in the 17th century. The massive fireplace is complete with utensils for cooking over the open fire, including a spit clock, driven by two heavy weights and designed to turn the roasting meat slowly over the fire.



The Hall i' th' Wood, a quaint old manor house near Bolton, where Crompton, the inventor of the spinning mule, spent his boyhood. Photograph by J. Jones, Prescot.

The Crompton room is the centre of interest. There he built his famous spinning mule, based on Hargreaves' spinning jenny and Arkwright's frame. This machine was able to spin a pound of cotton to a length of 950 miles of exceptional fineness, as compared to the 19 miles possible on Hargreaves' machine. Crompton fared badly with his invention, however, for he did not take out a patent, but disclosed his secret to manufacturers for a small payment. He received a belated grant of £5,000 from Parliament, but quickly lost it in business; and in his last days he had to rely for support on his friends.

Having seen the Hall I paid a visit to Crompton's birthplace at Firwood, a short distance away. The inventor first saw the light in a little thatched cottage that is in sharp contrast to the scene of his later life.

J. Jones (Prescot).

Aloft in an Avro "Anson"

I was particularly interested in the cover of the September *"M.M."* and in the article in that issue describing the Avro "Anson" aircraft, because I am a member of the Royal Air Force Cadet Wing of my school O.T.C., and was one of some 250 cadets who flew in "Ansons" when visiting R.A.F. Stations from their O.T.C. camps last summer.

All these cadets were transported to and from different aerodromes solely by Avro "Ansons," except on the last few days at camp, when buses transported us because all aeroplanes were wanted for manœuvres. Thus an article describing the "Anson" in detail was very helpful to me, as I am sure it was to others. Each machine carried four cadets in addition to the pilot, and we were all wearing observer-type parachute harness. This consists of webbing fixed on the body and a detachable parachute folded in a pack; it is kept handy, and can easily be clipped on to the harness in an emergency. It hangs in front of the body with the zip-ring in a convenient place.

I was flown to Upper Heyford, Tangmere, and Gosport, and also had a reconnaissance flight over London. On this trip I was given a map and told to follow the course the pilot took.

R. W. Edwards (Grantham).

Model-Building Made Easy

A Beginner's Guide to Construction

AT this time of the year there are thousands of newcomers to Meccanoland who are enjoying the thrills of model-building for the first time. Every owner takes the greatest pride in his models, and there is no more delightful moment than when one that is well built is set to work, but the fun is greatest when the construction is carried out in a workmanlike manner. The constructor soon learns to know the names of the parts he uses, and has no difficulty in following the instructions given in the Manuals included in the Outfits. This article is intended to give him further help by showing how small but interesting models are built up step by step.

Each model shown in the Manual of Instructions supplied with the Meccano Outfits is accompanied by a list of the parts required to build it. It is a good plan, at any rate for the first few models, to lay out on the table all the parts required for the model it is proposed to build, and to put the remainder of the Outfit on one side. If there is any difficulty in identifying a part from its name, it should be looked up in the illustrated list of parts on the back cover of the Manual.

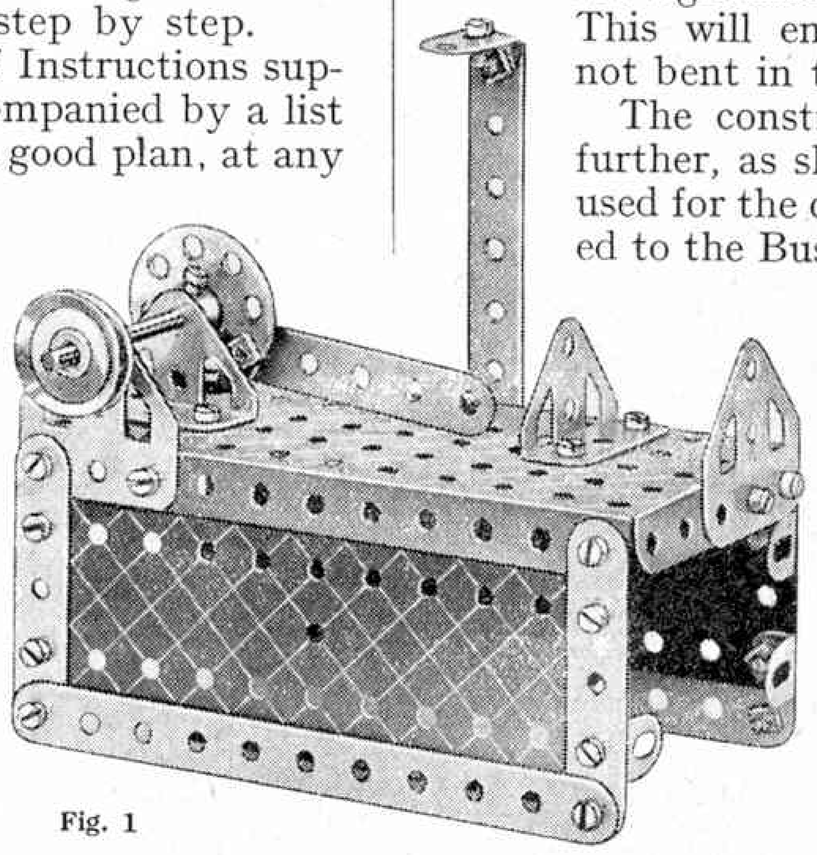


Fig. 1

Where the construction of a model should be started depends upon the subject and its design, but in almost all small models there is one main part that acts as a base or support for all the other parts. In the case of many of the small models shown in the Instructions Manuals this main part is a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate, and generally this should be taken as the starting point. The plan is well illustrated by the construction of the simple model shown in Figs. 1-4. This represents a horizontal steam engine. It can be built with a No. 2 Outfit, and it is fine to see it growing stage by stage, as shown in the illustrations, with the knowledge that it is being built up in real engineering style, and will work correctly when finished.

In constructing any model of this type it is always best to commence with the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate that forms the bed-plate, or base, on which the engine rests. To this are bolted the $2\frac{1}{2}''$ Strips that form the legs, as shown in Fig. 4 on the opposite page. One of the bolts used also supports a Flat Trunnion and this is fixed in position at the same time. This is an interesting point. If the Trunnion were not bolted on at this stage, some of the work would have to be undone in order to get it in, and the model-builder should keep a look out for occasions of this kind. The instructions and illustrations will help him. Another point to watch is that all bolts should be tightened up firmly with the Screwdriver and Spanner when the construction is completed.

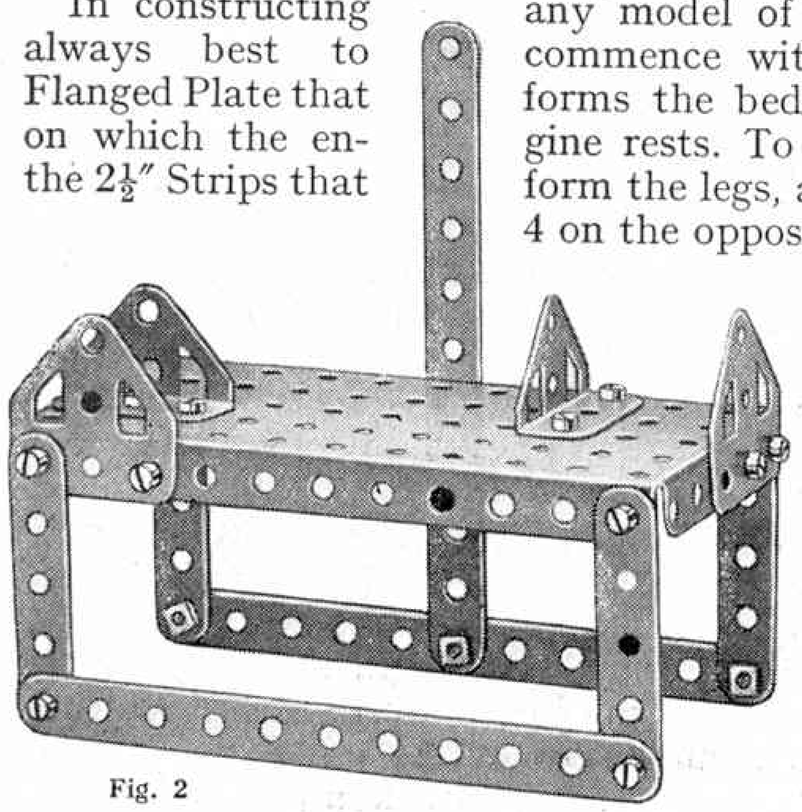


Fig. 2

Fig. 2 shows the construction carried a stage further. The framework is now completed, and the sides of the base are next filled in with Plates or Strips. In doing so it is advisable to see that none of the bolts holding the parts are tightened up until all the bolts are in position. This will ensure that the Plates or Strips are not bent in the process.

The construction can now be carried a stage further, as shown in Fig. 1. The $2\frac{1}{2}''$ Strip that is used for the connecting rod of the engine is attached to the Bush Wheel in such a manner that while it is held in position it is free to pivot or turn round on the bolt on which it is mounted. It is prevented from coming off its bolt by means of two nuts. This is a constructional dodge that is often used. The bolt is first passed through the $2\frac{1}{2}''$ Strip and a nut is screwed on to its shank, but is not tightened up sufficiently to grip the Strip. The bolt is then passed through the Bush Wheel, and a second nut is screwed on to it. The second nut is tightened up so that the Bush Wheel is gripped securely between it and the first nut. The first nut should be held with a Spanner while the second one is tightened up against it.

The final stage of the construction consists of adding the Crank Handle and the piston rod, and the model is then complete and should appear as shown in Fig. 3. The Crank Handle is passed through holes in the flanges of the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate, and is prevented from sliding horizontally by a 1" Pulley and a Spring Clip. When a Spring Clip is used in this manner it is always advisable to space it from the Plate by a washer, in order to prevent the enamel from being scratched. Finally the lamp is fitted. This is taken from a Meccano Lighting Set, and its use adds greatly to the attractions of the model, although it is not necessary to its work. Little touches of this kind give a model special interest.

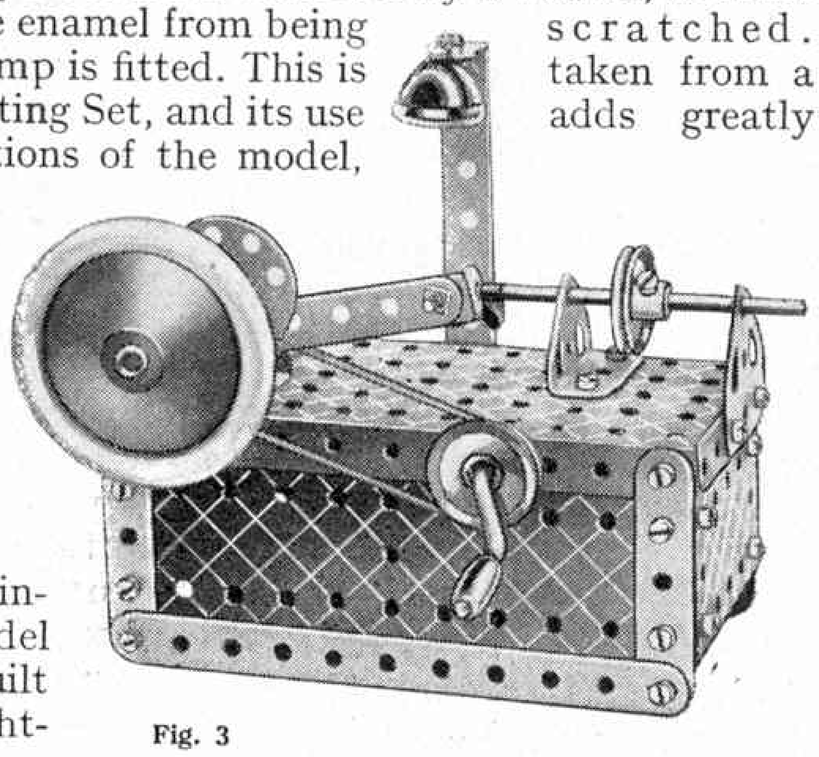


Fig. 3

This is an instance of a model that is best built up in a straight-

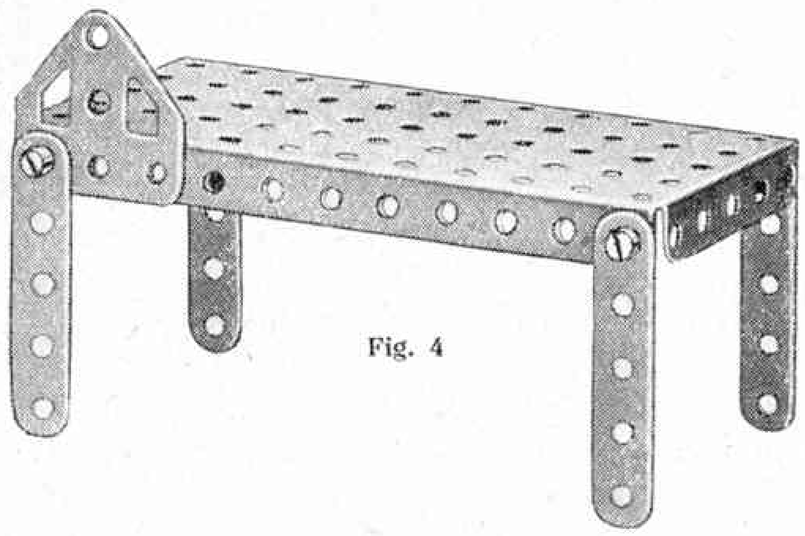


Fig. 4

forward manner from its base. Others are most easily constructed in units, or complete sections, which are assembled separately and bolted together. Many different types of models can be dealt with in this way, and a good example is the model motor breakdown lorry shown in various stages of building in Figs. 5, 6 and 7. In this case there are three sections, the body, the bonnet and the crane.

The bonnet is shown in Fig. 5 and is easily built up of two Flanged Sector Plates, which are joined at their forward ends by a $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flanged Plate and at the sides by two $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates. The $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flanged Plate must be fitted first, for it would not be easy to insert the nuts for the bolts that pass through it if the $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates were in the way.

Here is another example of the use of bolts to fasten more than two parts

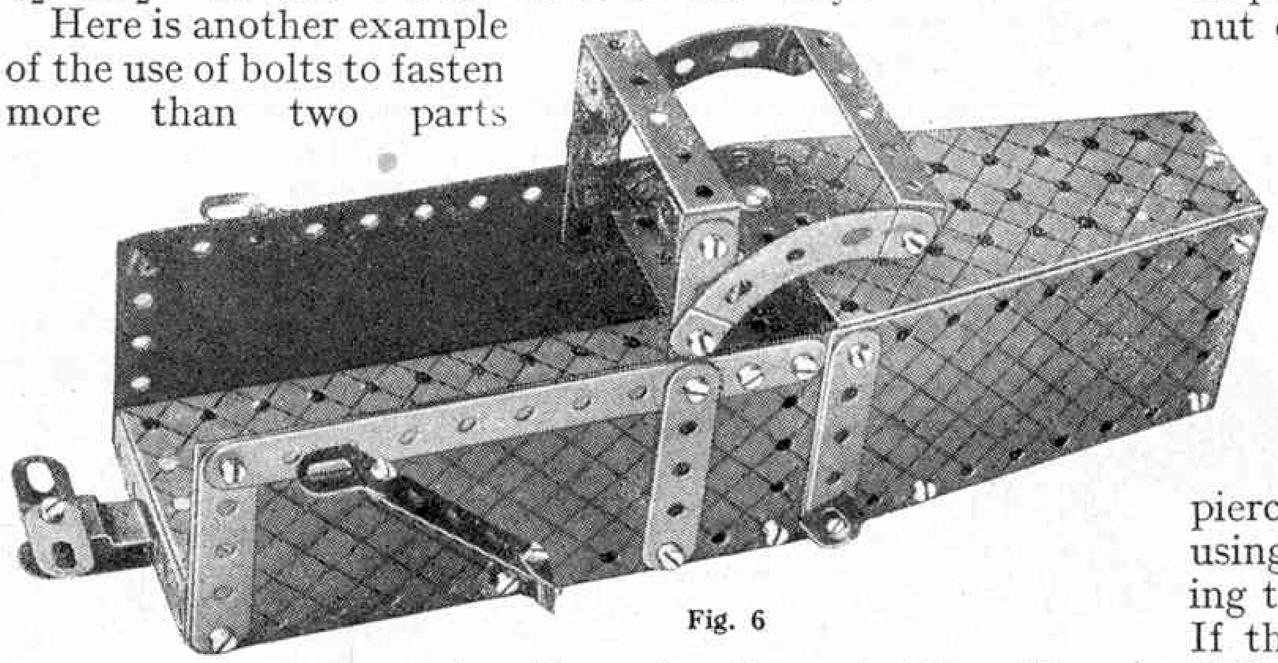


Fig. 6

together, for those holding the Flexible Plates also carry the Flat Brackets and Strips that later on will be used to fit the bonnet to the body. Again the illustration makes this clear and the model builder should have no difficulty on this point. Before these bolts are tightened up, a Rod should be temporarily inserted through the holes in the Flexible Plates and the Flanged Sector Plate that the front axle will occupy. This will ensure that the axle will turn freely in its bearings when it is placed in position. This precaution also should be taken when the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates are being secured to the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate, to ensure that the rear axle will run freely.

The body is next built up as shown in the left half of Fig. 6, and then the frame of the cab is added. A point to note is that the unprotected edges of the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates used for the sides of the body are braced by $5\frac{1}{2}''$ and $2\frac{1}{2}''$ Strips in order to prevent the Plates from being twisted or damaged. The body and bonnet are then fastened together by the Strips and Flat Brackets previously mentioned.

All that is now necessary is to complete the cab and add the mudguards and the crane. It will be seen that the mudguards are designed so that it is not necessary to bend any part in forming them. The steering wheel in the cab is a Bush Wheel, and it is secured on the upper end of a 2″ Rod, which is journalled in the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate and a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip secured between the sides of the body. A Spring Clip is pressed on to the 2″ Rod below the Flanged Plate.

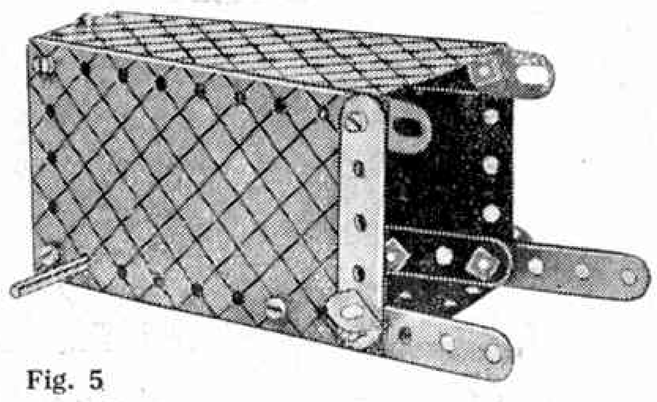


Fig. 5

The sections of the crane can be seen in Fig. 7, which illustrates the model at the stage when these are being assembled in position. The end of the length of Cord that is used for the hoisting cord should be secured to the Crane Handle by means of a Cord Anchoring Spring.

The method of mounting the 1″ Pulley that represents the searchlight on the cab roof, is one that is often used in small models. An Angle Bracket is bolted to the $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate and a bolt is passed through its free hole into the boss of the 1″ Pulley. The set-screw in the boss is then tightened up to lock the Pulley firmly in position.

During the construction of a model it is best to screw up the nuts with the fingers, followed by just a light turn with the screwdriver, leaving the final tightening with Spanner and Screwdriver until all the parts are connected up.

New model-builders sometimes find a little difficulty in placing nuts on bolts in awkward places. When the nut cannot be placed on the bolt with the fingers it is a good idea to stick it to the end of a long Strip with some tacky substance such as a small piece of modelling clay. On the other hand bolts can be inserted in places difficult of access by attaching them to a piece of wire, which should be wrapped once or twice around their shanks. The wire handle will then allow the bolts to be manœuvred easily into position.

Many Meccano parts, such as Angle Brackets, Flat Brackets, Angle Girders and Flat Girders, are pierced with both round and slotted holes, and when using these parts it is advisable to see that the bolts securing them in position are passed through the round holes. If the bolts are passed through the slotted holes, it is difficult to secure the parts in the correct positions.

Model-builders who meet with any difficulties or who wish to have further information on any points not clear from the Manual instructions and illustrations should write to Meccano Ltd., Binns Road, Liverpool 13, where there is a special staff of model-building experts always ready to help and advise them.

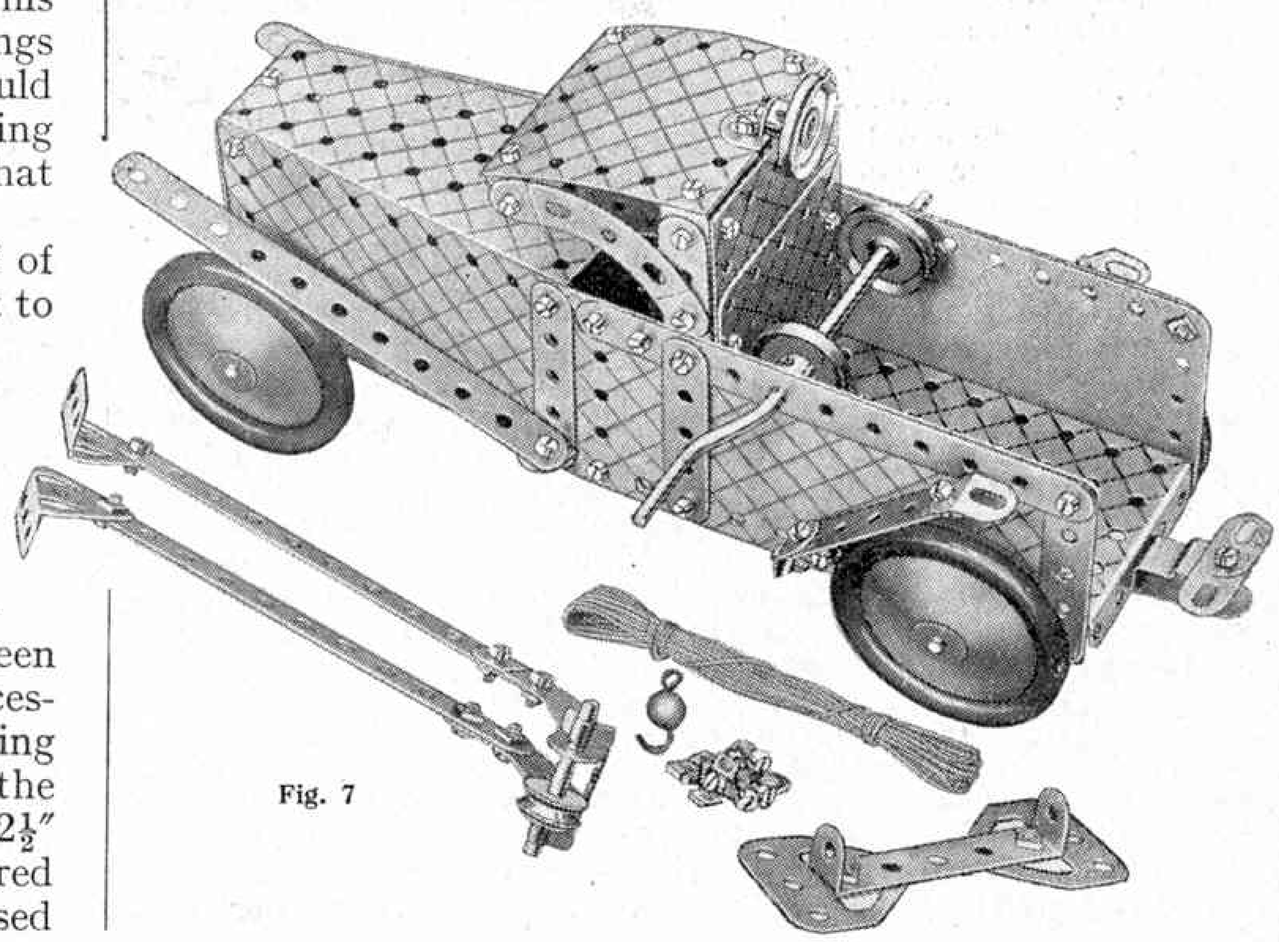


Fig. 7

Meccano Suggestions Section

By "Spanner"

(425) A New Driving Gear for Cranes

(K. Wallace, Motherwell)

Cranes and similar models incorporating a rotating superstructure usually are controlled from the cab, in which the driving Motor and gear-box are situated. In large models it is often more desirable to arrange the Motor and controls in the base of the model so that the operator does not have to change his position as the superstructure is rotated. K. Wallace, Motherwell, uses this method and details of his arrangement are shown in Figs. 425 and 425a.

The mechanism is shown mounted on a framework built to represent the base of a crane. The Hub Discs 1 and 3 form the lower and upper races respectively of a built-up roller bearing, in which the rollers are ½″ fast Pulleys supported by a Circular Strip 2. The lower Hub Disc is fitted with a Bush Wheel at its centre, and to the upper Hub Disc a 3½″ Gear Wheel is attached by four Reversed Angle Brackets. The central shaft 4 forms a pivot for the upper race, and carries a ½″ Pinion that is free to rotate on the Rod. The Rod is held in position by Collars, which serve also to hold the roller races together.

The 57-teeth Gear 5 is fixed on a 2″ Rod, bearings for which are provided by the Hub Disc and a Double Bent Strip. The Gear meshes with the ½″ Pinion on the central shaft. The 57-teeth Gear 6 also meshes with this Pinion, and is fastened on a 2″ Rod that passes through holes in the 3½″ Gear and the Hub Disc. The height of the 57-teeth Gear should be adjusted so that it does not foul the lower Gear Wheel.

A third Rod 2½″ long is journalled in Hub Disc 1, and at its upper end carries a ½″ Pinion. The Pinion meshes with the 3½″ Gear Wheel bolted to the upper race. The two Rods projecting from the upper roller race in Fig. 425 are each fitted with a ⅞″ Bevel Gear, through which the drive can be transmitted to the drums controlling hoisting and luffing.

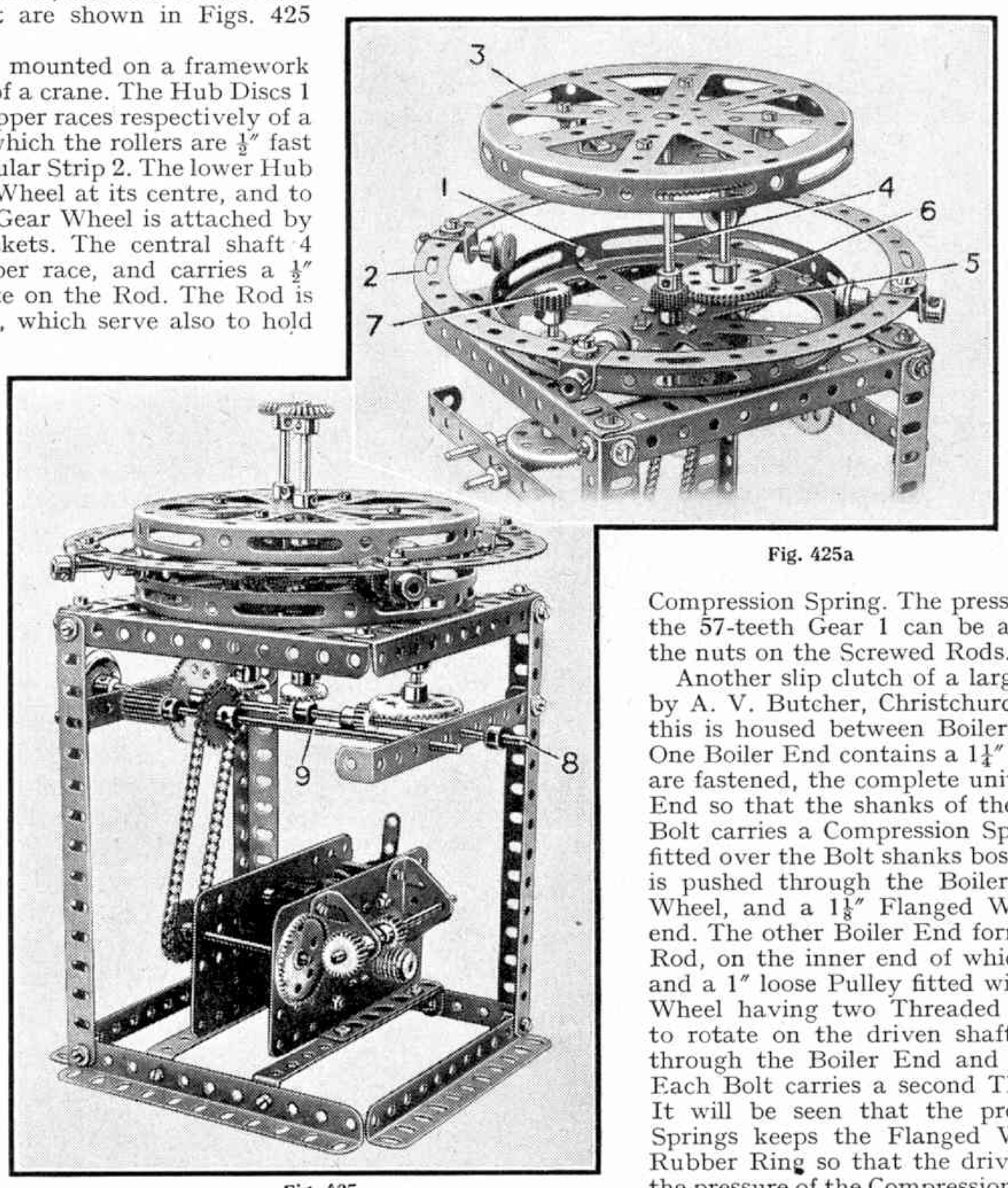


Fig. 425

A suggested arrangement for driving the various Rods is also shown. Rod 8 is free to slide in its bearings, and on it are fastened a 57-teeth Gear and two ½″ Pinions. The Rods protruding from the lower Hub Disc 1 are fitted with Contrate Wheels, with which the ½″ Pinions can be meshed. The drive from the Electric Motor is taken to the Rod 9, on which is fixed a ½″ diam. ¾″ face Pinion. In order to facilitate the movement of the Rod 8 a 1″ Pulley is fitted between two Collars on one of its ends. If it is desired to control more than one movement at a time, each Contrate Wheel must of course have its driving Pinion mounted on a separate shaft.

Another method of transmitting the drive to the superstructure is that of using the central shaft only. If this is arranged to slide vertically, the Pinion fixed to its upper end can be placed to mesh with either one of two Contrate Wheels fixed on separate shafts, one of which is used to raise the load, while the other transmits the drive to the traversing mechanism of the hoist crab. A disadvantage of this scheme is that the Rod would tend to bind in its bearings if a very heavy load were applied to one end of the superstructure.

(426) Slip Clutch

(H. Lambert, Birmingham and A. V. Butcher, Christchurch, N.Z.)

In models that are required to operate for long periods without attention it is advisable to include some form of slip clutch in the transmission. In the event of an obstruction causing the driven member of the model to stop, the clutch will then allow the driving Motor to continue running although the driven member is stationary, and thus damage to the Motor or other parts of the mechanism is prevented.

A simple slip clutch that will transmit quite heavy drives, and yet slip when overloaded, is shown in Fig. 426. The driving member is a 57-teeth Gear 1 and it transmits the drive to the Rod 2, which carries a fixed Collar. The latter is fitted with a Dinky Toys rubber tyre, which is held in frictional contact with the face of the 57-teeth Gear by a Bush Wheel. The latter part is free on Rod 2, and is connected to the Gear 1 by four 1″ Screwed Rods, each of which carries a Compression Spring. The pressure between the tyre 3 and the 57-teeth Gear 1 can be adjusted by screwing down the nuts on the Screwed Rods.

Another slip clutch of a large type has been submitted by A. V. Butcher, Christchurch, N.Z. The mechanism of this is housed between Boiler Ends joined by 2″ Strips. One Boiler End contains a 1¼″ Disc to which four ¾″ Bolts are fastened, the complete unit being bolted to the Boiler End so that the shanks of the Bolts point inward. Each Bolt carries a Compression Spring, and a Bush Wheel is fitted over the Bolt shanks boss outward. The driving Rod is pushed through the Boiler End, 1¼″ Disc and Bush Wheel, and a 1⅛″ Flanged Wheel is then locked on its end. The other Boiler End forms a bearing for the driven Rod, on the inner end of which is a 1½″ Contrate Wheel and a 1″ loose Pulley fitted with a Rubber Ring. A Bush Wheel having two Threaded Bosses fixed to it is free to rotate on the driven shaft, and ¾″ Bolts are passed through the Boiler End and into the Threaded Bosses. Each Bolt carries a second Threaded Boss on its shank. It will be seen that the pressure of the Compression Springs keeps the Flanged Wheel in contact with the Rubber Ring so that the drive is transmitted. To adjust the pressure of the Compression Springs it is only necessary to rotate the Threaded Bosses on the ¾″ Bolts.

Fig. 425a

A useful application for these mechanisms will be found in automatic models in which a reversing gear is incorporated. For example, in a model transporter bridge the exact time taken by the carriage to traverse the span is difficult to estimate, and it sometimes happens that the gear-box tends to over-run when the carriage has reached the end of its travel. If a slip clutch is fitted, however, the gear-box can continue to operate without straining the Gears and shafts until it automatically reverses.

(427) Governor Controlled Gear-Box (R. Clarke, Walsall)

R. Clarke, Walsall, recently forwarded details of an automatic variable speed gear-box, in which the gear-ratios between the driving and driven shafts are adjusted automatically by a centrifugal governor. The gear-box is of the ordinary 3-speed type incorporating a sliding lay-shaft, and the latter is connected by brackets to the sliding portion of the governor links in such a manner that a lower ratio is brought into operation when the weights fly outwards.

(428) A New Ball Bearing (W. Goodale, Weston, Mass., U.S.A.)

The Meccano system includes two complete bearings, and of these the most efficient is the Geared Roller Bearing (Part No. 167), the special design of which makes it admirably suitable for incorporation in large and heavy models. The second unit is the Meccano Ball Bearing (Part No. 168). This is compact and self-contained, and forms an ideal bearing for small models incorporating rotating superstructures.

Models of intermediate size require built-up roller or ball bearings, and an ingenious bearing of the latter type is shown in Fig. 428. It was designed by W. Goodale, Weston, U.S.A., and can serve either as a horizontal ball-bearing or when mounted vertically, as a journal bearing. The second of these applications will be found especially useful in building big wheel models and similar structures. No doubt many other uses also can be found for it.

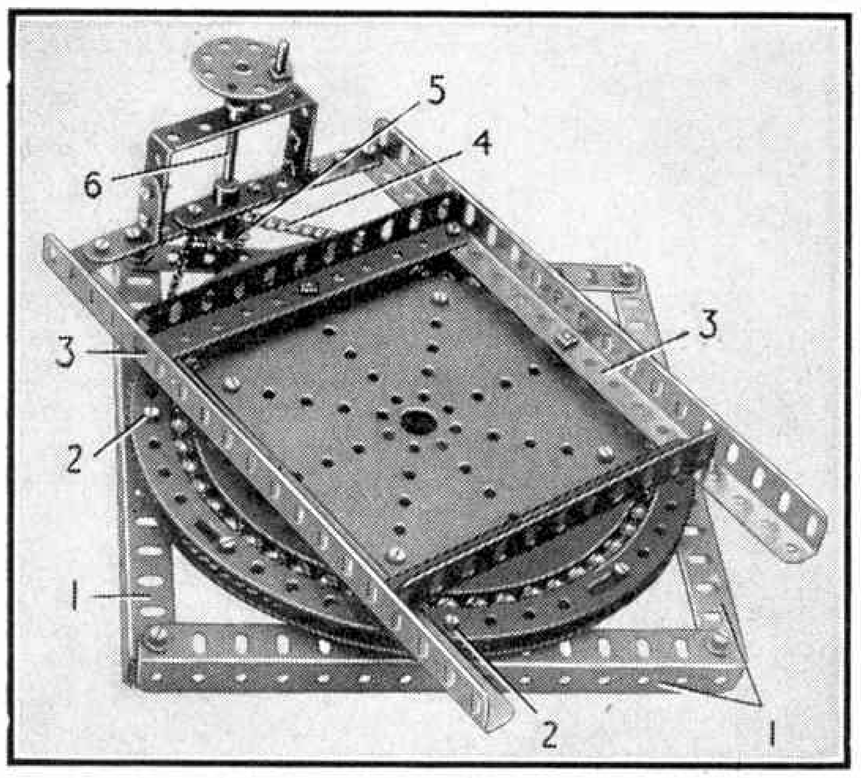


Fig. 428

The construction of the bearing is very simple. Two 6″ Circular Plates are placed face to face, and are spaced apart by a Collar and washer placed on the shank of each of the eight ½″ Bolts connecting the Plates. The outer rim comprises two 7½″ diameter Circular Strips, and these also are connected together. Each Bolt carries an Aeroplane Collar (Part No. P.52) and a Washer. Eight Bolts are used to connect the Circular Strips, but one of these is not fitted for the time being and the Bolts on each side of its position are left slack.

The component is now laid inside the other on a flat surface, and 52 Steel Balls (part No. 117) are fitted in the space between them. The reason for omitting one of the Bolts in the Circular Strips will now be seen, for when about half the Steel Balls have been placed in position, no more can be pushed between the edges of the Circular Strips and Plates. The Circular Strips are therefore levered apart with the fingers and the remaining Steel Balls pushed into place between them. When all the Balls are in position, the remaining Bolt is inserted.

The bearing is now ready for use, and one method of incorporating it in such a model as a hammerhead crane is shown in Fig. 428. The 7½″ Angle Girders 1 are bolted to the Circular Strips by Bolts 2, and are connected together at their ends. These Girders form the top of the tower. The Girders 3 and the cross members joining them are each spaced from the Circular Plates by a Collar and a nut fixed on a 1″ Screwed Rod. These Girders form the centre part of the superstructure.

The method of swivelling the superstructure is also shown. The Sprocket Chain 4 is of sufficient length to pass around the Circular Strips and the ¾″ Sprocket Wheel 5 on the end of Rod 6. The superstructure is rotated by turning Rod 6 from the driving Motor. Alternatively a 1″ Pulley shod with a Rubber Ring can be arranged to bear against the upper Circular Strip and turn the superstructure by friction drive.

(429) Intermittent Motion (P. Hill, Hull)

A useful mechanism for producing a reduction ratio of 5:1 is shown in Fig. 429. It was designed by P. Hill, Hull, for incorporation in a counting machine, and was used in conjunction with a 2 : 1 gearing to give a total reduction of 10 : 1. The device consists of a Rod Socket 2 to which five Angle Brackets are fixed. Each Angle Bracket carries a Threaded Pin with which the Threaded Pin 1, fixed to the end of a Crank, engages.

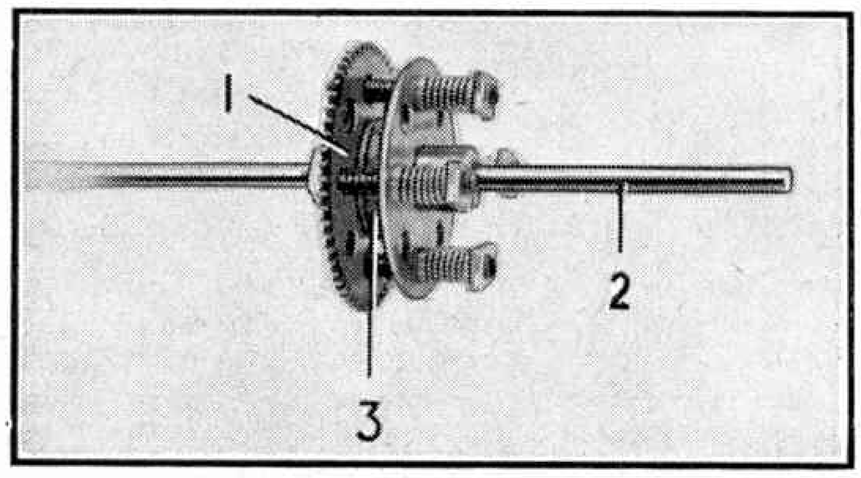


Fig. 426

(430) Two Simple Meccano Ratchets (O. Farrow, London N.3)

In many models some kind of ratchet mechanism that will allow a shaft to rotate in one direction only is required, and this can be assembled quite easily from a Meccano Pawl (Part No. 147) and a Ratchet Wheel (Part No. 148). When these parts are not available, however, it is necessary to devise the mechanism from others not specially designed for the purpose.

Two examples of how this can be done are shown in Fig. 430. Both of these mechanisms were designed by O. Farrow, London N.3, and each consist of only a few parts. The "ratchet wheel" in the left-hand mechanism is a Spring Clip, and in the right-hand mechanism a Collar is used. The pawl in each case is an Angle Bracket, which is free to slide by its slotted hole on a lock-nutted bolt, and is supported by a second Angle Bracket bolted in the position shown. It will be seen that when the Rods carrying the Spring Clip and Collar are rotating in an anti-clockwise direction the respective Angle Brackets will not impede the motion of the Rods. If the rotation of the Rods is reversed, however, the lugs of the Spring Clip and the grub screw of the Collar immediately engage with their respective Angle Brackets and prevent further rotation. The fixed Angle Brackets should be arranged as shown in the illustration so that the free Brackets slide easily into contact with the Collar or Spring Clip under their own weight.

(431) A Drip Feed Lubricator (H. Roberts, Birmingham)

Meccano gear-boxes and similar mechanisms that are required to work continuously for long periods without attention must be provided with an efficient lubrication system in order to ensure smooth and silent operation. Generally some form of drip lubrication, in which drops of oil are supplied to the gears and bearings at regular intervals, will be found satisfactory. There are many different methods of doing this, and one device that is suitable for use in various kinds of mechanisms can be made up as follows.

A Chimney Adaptor is fitted with a Grease Cup, which is lock-nutted to its base. The cap of the Cup is removed and a piece of wick is threaded through the hole in its base. The unit is then suspended over the part to be lubricated by means of a Pendulum Connection bolted to a convenient point on the frame of the model. The Chimney Adaptor is then filled with oil.

When the gear-box is in operation, small vibrations set up will cause drops of oil to drip slowly from the wick on to the rotating gears below.

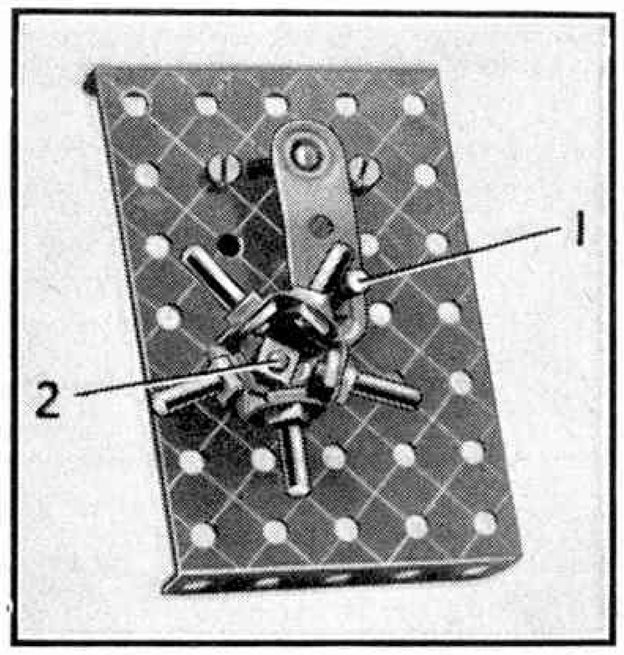


Fig. 429

MISCELLANEOUS SUGGESTIONS

M206. H. Nelson, Leeds, has experienced difficulty in securing Strips or similar parts to Sprocket Chain owing to the bolts fouling the teeth of the Sprocket Wheels over which the Chain passes. This trouble can readily be overcome by attaching Angle or Flat Brackets to the Chain. For this purpose the Chain is doubled and passed through the slotted hole of the Bracket, where it is held in position by means of a bolt or wire pushed through the loop. Meccano parts can then be fixed to the Bracket as desired without fear of the bolts touching the Sprocket Wheel. This novel idea will prove useful to other model-builders.

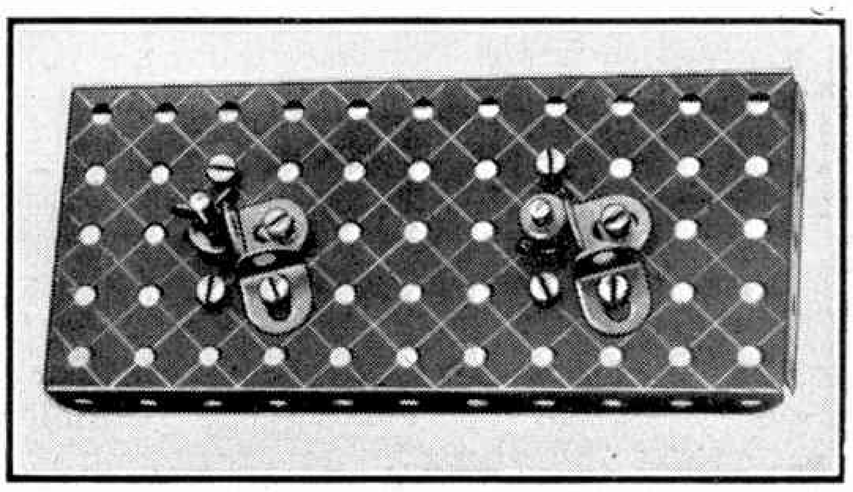


Fig. 430

Working Models for Every Meccano Owner

Attractive Subjects for Small Outfits

ONE of the secrets of the fascination of Meccano is the ease with which the youngest model-builder can construct splendid models that actually work, even when he has only comparatively few parts at his disposal. The models we are describing this month prove this. There are five of them, and for none of these are more parts required than are to be found in Outfit No. 3. One of the most attractive, a model of an engineer's lathe, can be built with Outfit No. O, so that here is a model which every Meccano owner can build. A crane that will lift small loads can be built with a No. 1 Outfit, and then there are a miniature electric locomotive and a fire escape, both built with No. 2 Outfit. The fifth and largest is a fine working swing bridge, for which a No. 3 Outfit is required. All are easy to make, and the photographs of the actual models reproduced in these pages show them to be attractive in appearance and working.

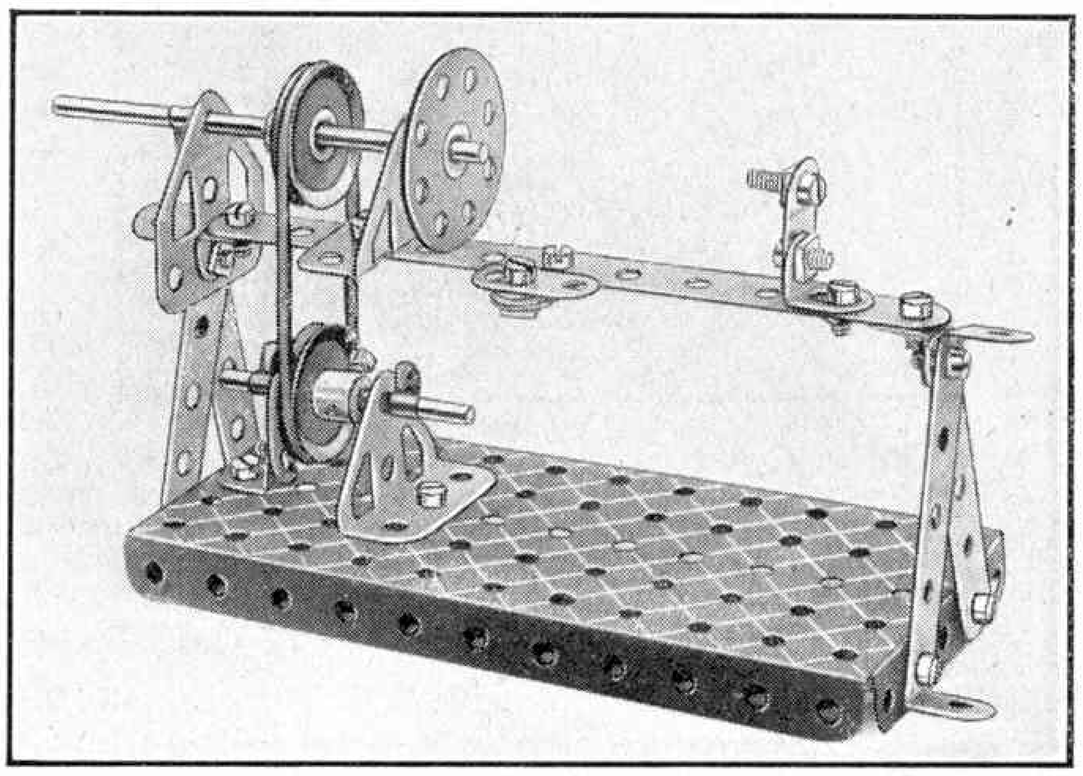


Fig. 1. A simple model of an engineer's lathe, which can be built from the contents of Outfit No. O.

The lathe built with Outfit No. O is shown in Fig. 1, and is built up on a base consisting of a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate. The lathe bed, which is a $5\frac{1}{2}''$ Strip, is supported at each end by a $2\frac{1}{2}''$ Strip and a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip. A $3\frac{1}{2}''$ Rod passed through the top holes in a Trunnion and a Flat Trunnion, arranged as shown in the illustration, carries at its centre a 1" Pulley, and at one end a Bush Wheel that forms the faceplate to which the work to be turned is fixed. The 1" Pulley is connected by a length of Cord to a second 1" Pulley on a 2" Rod, which is journalled, or fitted so that it is free to turn, in a Trunnion and a Flat Bracket mounted on the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate.

Parts required to build the model lathe: 1 of No. 2; 2 of No. 5; 4 of No. 10; 4 of No. 12; 1 of No. 16; 1 of No. 17; 2 of No. 22; 1 of No. 24; 3 of No. 35; 16 of No. 37a; 15 of No. 37b; 2 of No. 38; 2 of No. 48a; 1 of No. 52; 1 of No. 111c; 2 of No. 126; 1 of No. 126a.

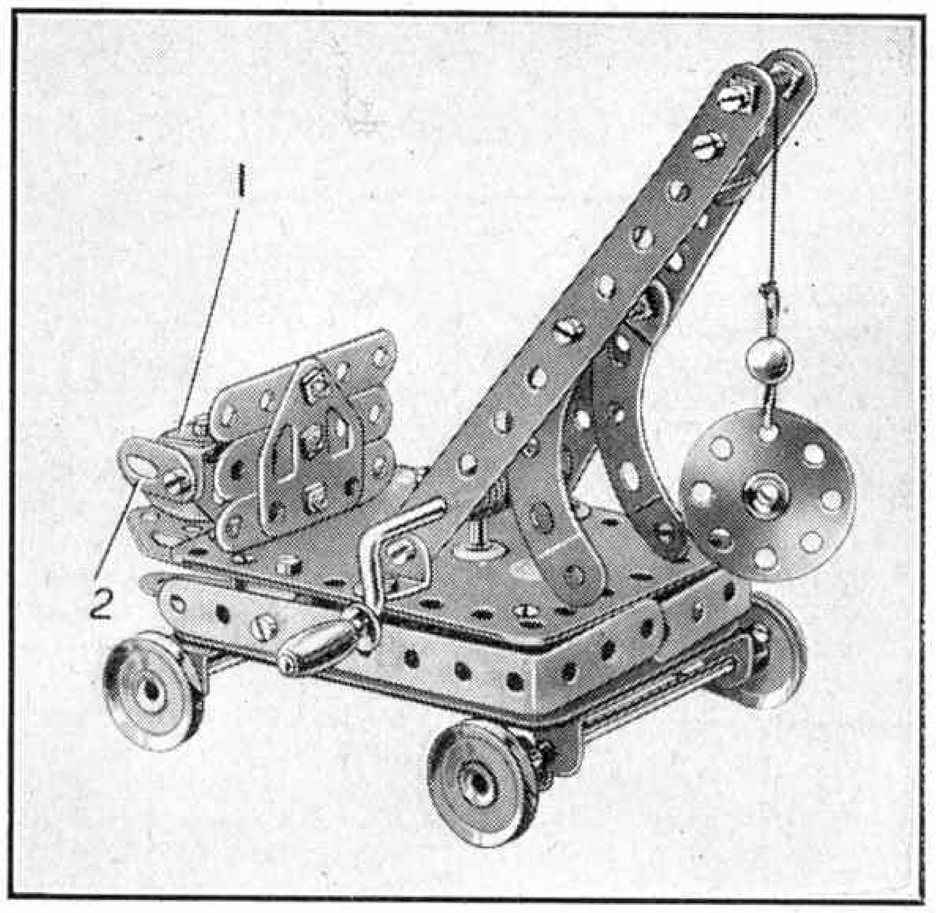


Fig. 2. This model crane is driven by a No. 1 Clockwork Motor and will actually lift small loads. Outfit No. 1 is required for its construction.

The mobile electric crane shown in Fig. 2 is built from the contents of Outfit No. 1. The body of the truck is formed by a No. 1 Clockwork Motor laid on its side, and under this are bolted the two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips that form the supports for the front and rear axles. The axles are $3\frac{1}{2}''$ Rods, and each of them carries a 1" Pulley at each end. One of the Pulleys on the rear axle is connected by a $2\frac{1}{2}''$ Driving Band to the driving shaft of the Clockwork Motor. The Driving Band is prevented from slipping off the shaft by a washer and Spring Clip, and it also passes around the lower end of a 2" Rod so that it is brought into line with the 1" Pulley on the rear axle. The 2" Rod cannot be seen in the illustration, but it occupies the hole in the side plates of the Motor next to the driving shaft, and is kept in position by a Spring Clip.

The driver's seat at the forward end of the truck is formed by a Trunnion 1. The latter is attached by an Angle Bracket to one of the three $2\frac{1}{2}''$ Strips mounted on the Motor by a Trunnion and a Flat Trunnion. The Trunnion 1 in turn carries a Flat Bracket 2 that represents the steering handle.

The crane consists of two $5\frac{1}{2}''$ Strips that are secured in position by Angle Brackets. The Strips are joined at their upper ends by a Reversed Angle Bracket, and they are additionally supported by two $2\frac{1}{2}''$ Curved Strips. A Crank Handle is journalled in the $5\frac{1}{2}''$ Strips as shown, and around its centre portion is wound a length of Cord. The free end of the Cord is passed over two $\frac{3}{8}''$ Bolts secured through the end holes of the $5\frac{1}{2}''$ Strips and is tied to a small Loaded Hook.

Parts required to build model mobile crane: 4 of No. 2; 3 of No. 5; 2 of No. 10; 5 of No. 12; 2 of No. 16; 1 of No. 17; 1 of No. 19g; 4 of No. 22; 1 of No. 24; 2 of No. 35; 26 of No. 37a; 24 of No. 37b; 3 of No. 38; 2 of No. 48a; 1 of No. 57c; 2 of No. 90a; 2 of No. 111c; 1 of No. 125; 1 of No. 126; 2 of No. 126a; 1 of No. 186; 1 No. 1 Clockwork Motor (not included in Outfit).

The construction of the No. 2 Outfit electric locomotive (Fig. 3) is commenced by making two compound plates from a $2\frac{1}{2}'' \times 1\frac{1}{2}''$ and a $5\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plate overlapped three holes, and bolting these to the flanges of a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate that forms a base for the body of the model. The compound plates form the sides of the locomotive and are joined at their ends by $2\frac{1}{2}''$ Strips and Angle Brackets. The illustration shows how this is done. The sides of the cab consist of two $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates, which are bolted to the two compound plates and then joined by two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips. The roof of the cab is a $1\frac{11}{16}''$ radius Curved Plate, and is fastened by Angle

Brackets to the $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates. The bolts securing the Curved Plate hold also two Trunnions that support the wire frame that is used to represent the pantograph current collector of the locomotive.

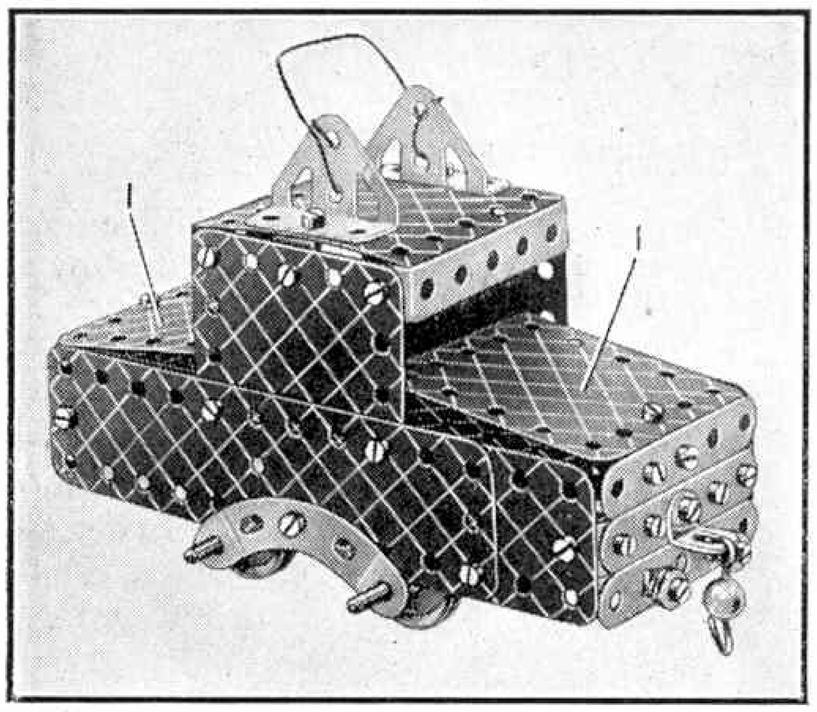


Fig. 3. A neat model of an electric locomotive constructed from the parts contained in Outfit No. 2.

The ends of the locomotive are filled in with two $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates 1, which are secured to the $2\frac{1}{2}''$ Strips by two Angle Brackets.

Four 1" Pulleys are used for the wheels of the locomotive and these are mounted on two $3\frac{1}{2}''$ Rods journalled in the end holes of two $2\frac{1}{2}''$ Curved Strips. The latter parts are bolted to the sides of the locomotive as shown in the illustration. One of the $3\frac{1}{2}''$ Rods carries also a $\frac{1}{2}''$ Pulley and this is connected by a Driving Band to the pulley of a *Magic* Motor bolted inside the model.

Parts required to build model locomotive: 6 of No. 5; 4 of No. 10; 1 of No. 11; 6 of No. 12; 2 of No. 16; 4 of No. 22; 42 of No. 37a; 34 of No. 37b; 4 of No. 38; 2 of No. 48a; 1 of No. 52; 1 of No. 57c; 2 of No. 90a; 4 of No. 111c; 2 of No. 126; 1 of No. 186; 2 of No. 188; 2 of No. 189; 2 of No. 190; 1 of No. 199; 2 of No. 200; 1 *Magic* Motor (not included in Outfit).

Fig. 4 shows an attractive model of a fire-engine with an escape that automatically erects itself. In action, the engine is run lightly against the wall of the "burning building" so that the front bumper is pressed backwards. This releases a catch, and allows the escape to spring upwards.

The chassis of the engine is formed by a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate, to one end of which two $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plates are bolted to represent the sides of the bonnet. A $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate is used for the top of the bonnet.

The back of the driver's cab consists of three $2\frac{1}{2}''$ Strips, fastened together by a Flat Trunnion and secured to the Flanged Plate by two Angle Brackets. The Plate also carries two Angle Brackets 2, the purpose of which will be described later.

The escape ladder is built up from two pairs of $5\frac{1}{2}''$ Strips. The lower pair are joined by a Flat Bracket and two Angle Brackets, and they are pivotally mounted by lock-nutted bolts on two Angle Brackets. The upper two Strips are joined by a Reversed Angle Bracket 3, which is spaced by two washers from each of the Strips, and they are connected to the lower pair of Strips by a 2" Rod. The escape is held in its erected position by two Driving Bands 4 and 5, arranged as shown in the illustration.

The bumper is a $2\frac{1}{2}''$ Strip, which is mounted by an Angle Bracket on the end of a compound strip formed from a $5\frac{1}{2}''$ and a $2\frac{1}{2}''$ Strip overlapped three holes. The compound strip is not bolted in position, but is inserted between the Angle Brackets 2 and under the lower $2\frac{1}{2}''$ Strip forming the back of the driver's cab. The free end of the Strip is then bent as shown in the illustration.

To set the model ready for working, the escape is pushed down into the horizontal position, with the upper half folded over the lower, and the end of Strip 1 is placed over the Reversed Angle Bracket 3. The escape is thus held firmly in position until the bumper is pushed backwards and the Reversed Angle Bracket is released from the Strip 1.

Parts required to build model fire-engine: 5 of No. 2; 5 of No. 5; 7 of No. 12; 2 of No. 16; 1 of No. 17; 4 of No. 22; 4 of No. 35; 30 of No. 37a; 27 of No. 37b; 1 of No. 52; 2 of No. 111c; 1 of No. 126a; 4 of No. 155a; 2 of No. 186; 2 of No. 188; 1 of No. 190.

The remaining model to be described is the swing bridge shown in Fig. 5. This can be built from Outfit No. 3. The roadway of the bridge consists of two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ and two $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plates bolted end to end. Two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips are bolted one to each end of the compound plate so formed, and between their turned up ends are secured two $12\frac{1}{2}''$ Strips.

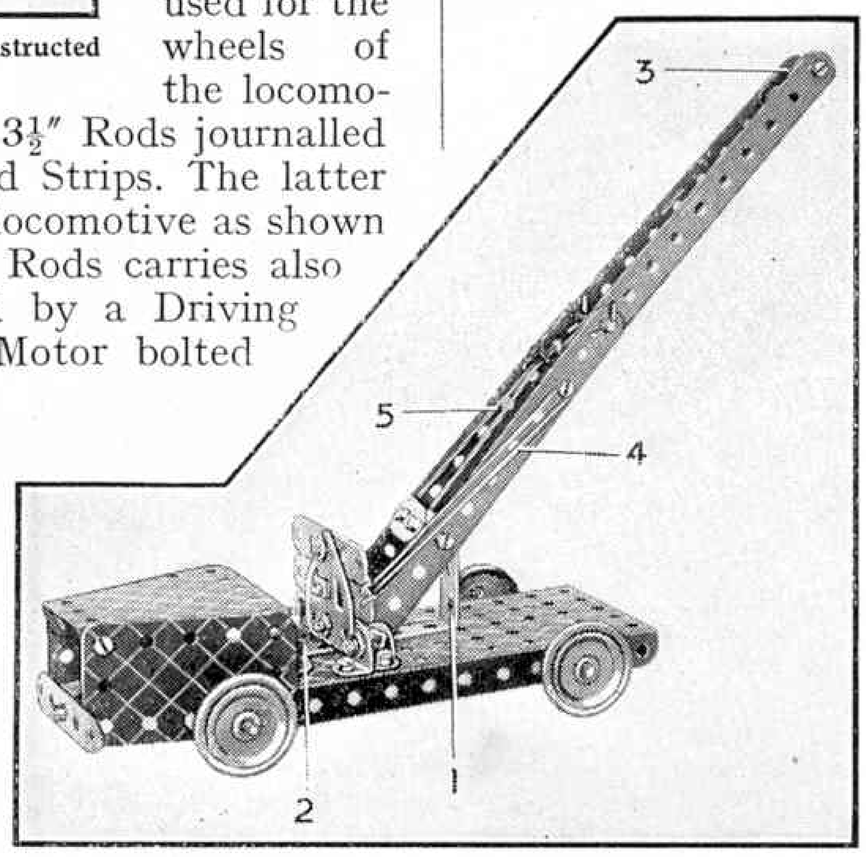


Fig. 4. This model fire-engine is fitted with an automatic escape, and can be built from Outfit No. 2.

Underneath the roadway at its centre is bolted a Bush Wheel, which carries in its boss a 2" Rod. A Road Wheel 2 is locked on the Rod, which is then passed through the centre hole of a $1\frac{1}{4}''$ Disc. Two Angle Brackets are bolted to the last-mentioned part, and to them two 1" Pulleys 3 are fastened by $\frac{3}{8}''$ Bolts. The Pulleys 3 form a bearing between the Road Wheel 2 and the Road Wheel 1, through which the 2" Rod is next passed. The Road Wheel 1 is clamped to a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate by a $5\frac{1}{2}''$ Strip, and the 2" Rod is held underneath the Flanged Plate by a Spring Clip.

The bridge is rotated on its bearing by turning the Crank Handle 4, which is journalled in two Flat Brackets supported from the Flanged Plate by Flat Trunnions. The Crank Handle is prevented from sliding endways by Spring Clips, and around its centre is wrapped a length of Cord. The ends of the Cord are tied to the bolts that fix the Bush Wheel to the roadway of the bridge.

Each of the piers is formed from a $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate 5, to which a $5\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plate and two Curved Plates are fastened. Two $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates are used for the roadways on the piers.

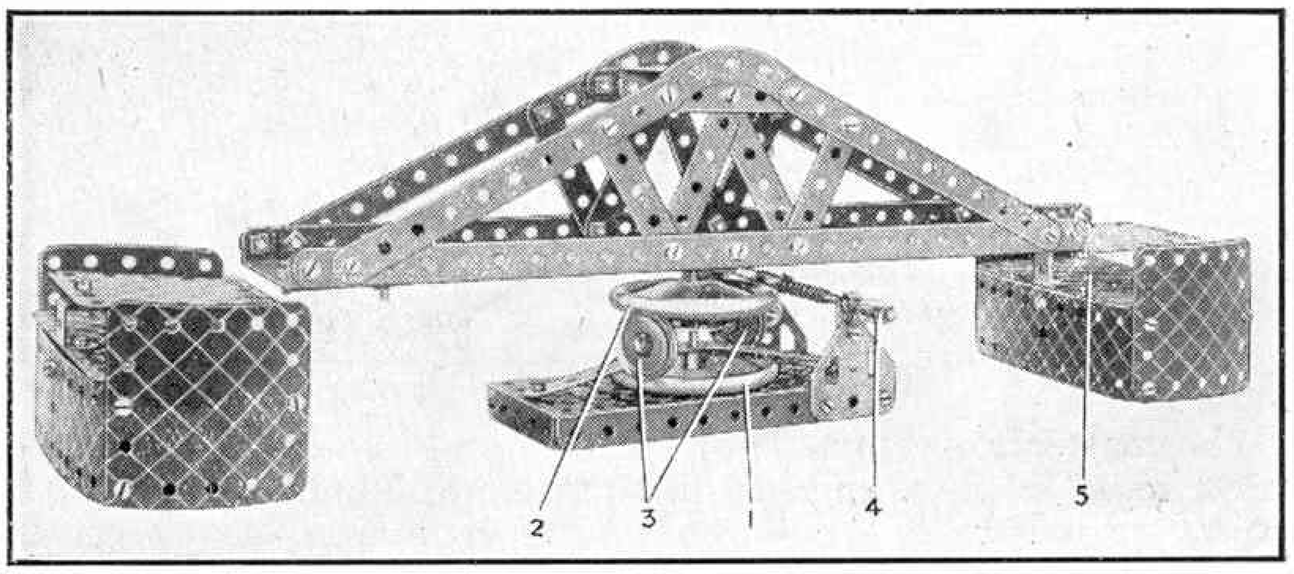


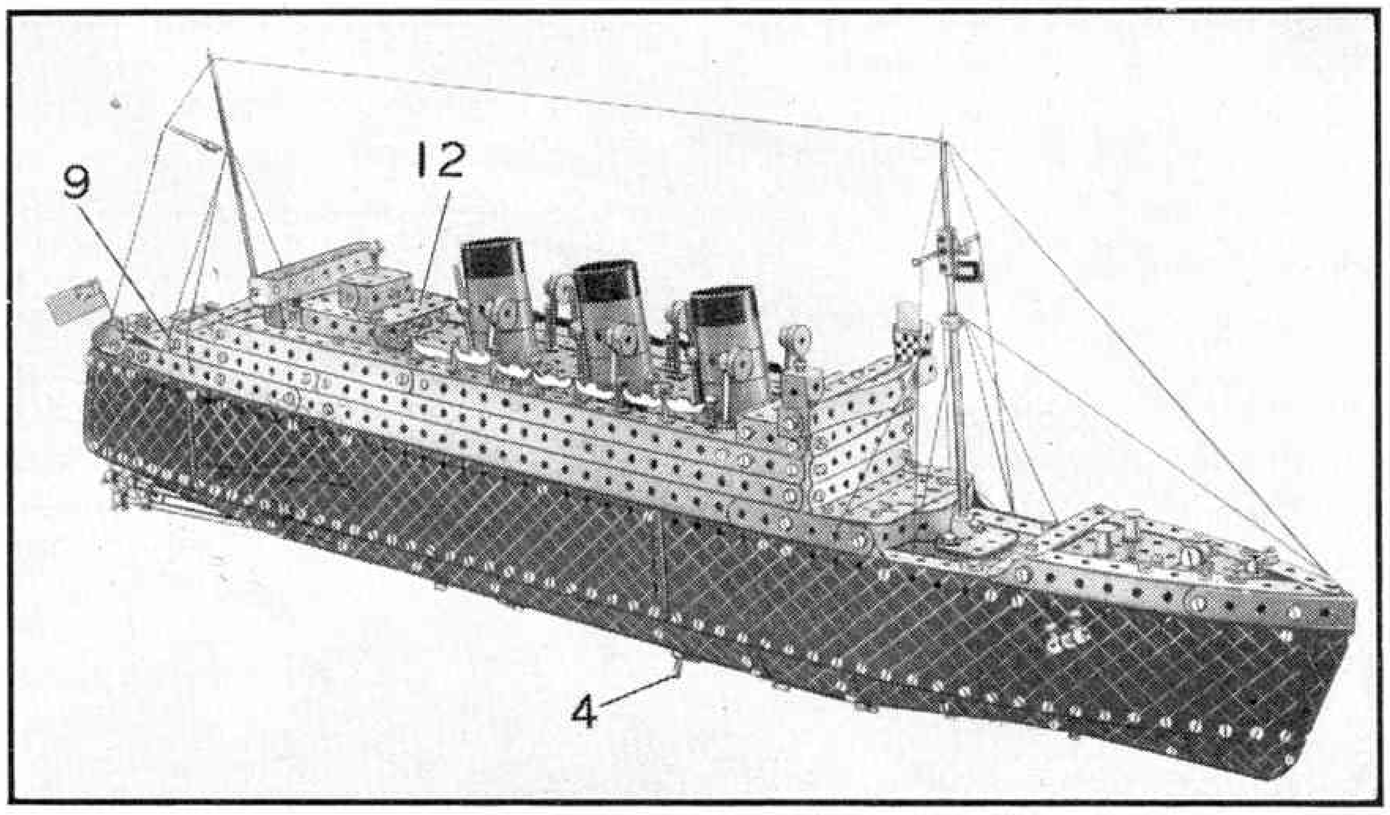
Fig. 5. Parts from an Outfit No. 3 are used in the construction of this fine model swing bridge.

Parts required to build model swing bridge: 2 of No. 1; 5 of No. 2; 9 of No. 5; 3 of No. 10; 2 of No. 11; 8 of No. 12; 1 of No. 17; 1 of No. 19g; 2 of No. 22; 1 of No. 24; 3 of No. 35; 68 of No. 37a; 68 of No. 37b; 7 of No. 38; 1 of No. 40; 2 of No. 48a; 1 of No. 52; 2 of No. 90a; 2 of No. 111c; 2 of No. 126; 2 of No. 126a; 2 of No. 188; 2 of No. 189; 2 of No. 190; 2 of No. 191; 2 of No. 199; 2 of No. 200; 1 of No. 217a.

Ship Model of Novel Construction

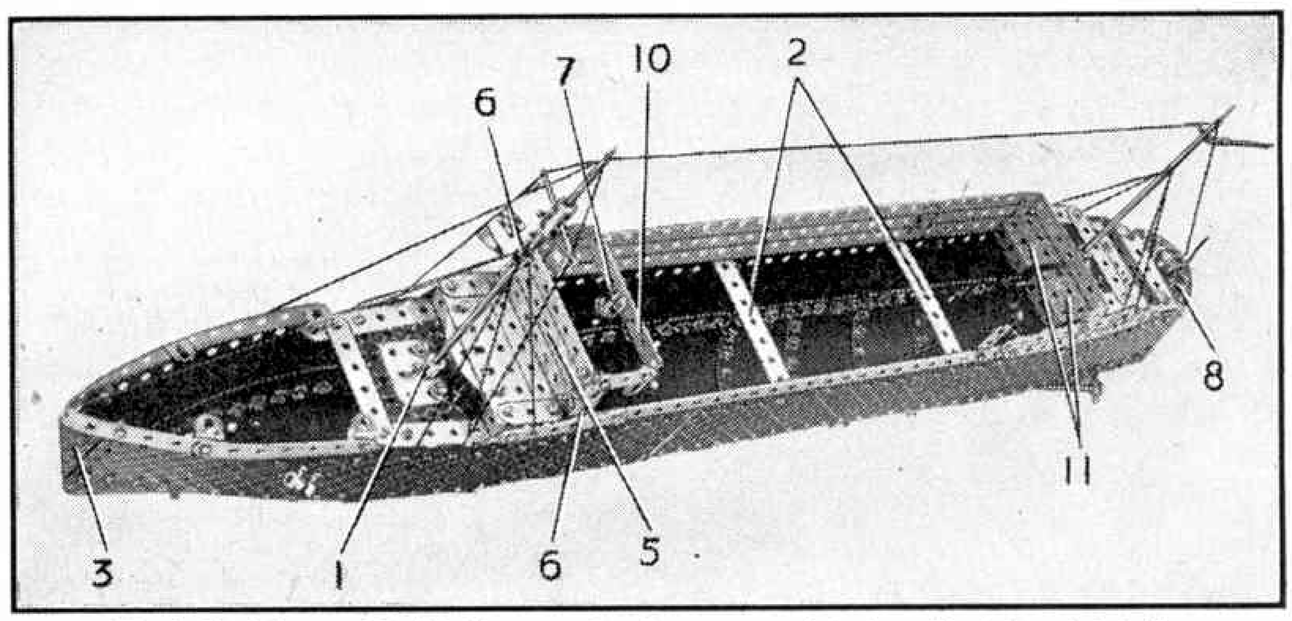
A Magnificent Meccano "*Queen Mary*"

THE splendid model of the famous Cunard White Star liner "*Queen Mary*" illustrated on this page is a triumph of Meccano model-building. It possesses the beautiful proportions and grace of its original, and indeed in this respect the photograph scarcely does justice to its fine lines. It is not a waterline model, but is a complete reproduction, from the masthead down to the underpart of the hull and the propellers and rudder, of the entire structure of the great liner. Skilful use has been made of Strips and Flexible Plates in building it, particularly in the modelling of the hull, and another feature of special interest is the faithfulness with which every part of the superstructure is reproduced, lifeboats, ventilators, and other details being constructed in true proportion.



The famous Cunard White Star liner R.M.S. "Queen Mary" modelled in Meccano. This fine reproduction is 30 in. long, with a beam of 3½ in., and its construction is described on this page.

Model-builders who favour the construction of ship miniatures will be particularly interested in the method of construction adopted. The hull was built up separately from the superstructure, and the two can readily be separated, as the lower illustration on this page shows. Ship model-builders usually complete their work by constructing the decks after finishing the hull, and when this plan is followed internal constructional details cannot be seen, while it may be necessary to dismantle part of the model if at any time alterations or additions are made. With this "*Queen Mary*" model there are no such difficulties.



The hull of the model with the superstructure removed to show the internal details.

The constructional details of the model will be of interest to all who are engaged in similar model-building efforts, as well as to those who wish to reproduce this splendid model itself. Each side of the hull consists of two $12\frac{1}{2}'' \times 2\frac{1}{2}''$ Strip Plates and a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate. The compound plates so formed are joined at the bows by a U-section Curved Plate 3, and at the stern by two $1\frac{11}{16}''$ radius Curved Plates. At the centre they are braced by two $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips 2. The underside of the hull is formed by 28-$1\frac{11}{16}''$ radius Curved Plates, which are arranged as shown in the illustrations. A Semi-Circular Plate is used to fill in the under part of the hull above the propellers.

The forecastle is built up from a $2\frac{1}{2}'' \times 2\frac{1}{2}''$ and a $3'' \times 1\frac{1}{2}''$ Flat Plate, which are bolted together and edged by two $5\frac{1}{2}''$ Curved Strips and a $3''$ Strip. An $11\frac{1}{2}''$ compound strip, consisting of a $5\frac{1}{2}''$ and two $3\frac{1}{2}''$ Strips, is bent to shape and then attached to the Curved Strips by Angle Brackets, and the complete forecastle is secured in position by Flat Brackets and $1''$ Corner Brackets.

The well deck is made from a $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate, and in the centre of it is mounted a Rod Socket 1, which provides a support for the forward mast.

The front of the superstructure below the bridge consists of three $3\frac{1}{2}''$ Strips 5, which are bolted between two $2\frac{1}{2}''$ Angle Girders 6 attached to the sides of the hull. The bridge itself is not fitted at this stage, but a $\frac{3}{4}''$ Bolt 7 is mounted as shown, so that the bridge can easily be secured in position later in the construction.

The $2\frac{1}{2}''$ Angle Girders 6 also form the supports for a number of compound strips that represent the sides of the superstructure. The compound strips differ in length, and each pair is joined across at their stern ends by a Double Angle Strip, thus giving the step-like structure leading from the stern to the boat deck. The "steps" are now filled in with a Semi-Circular Plate 8, a $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate 9 and two $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flanged Plates 11.

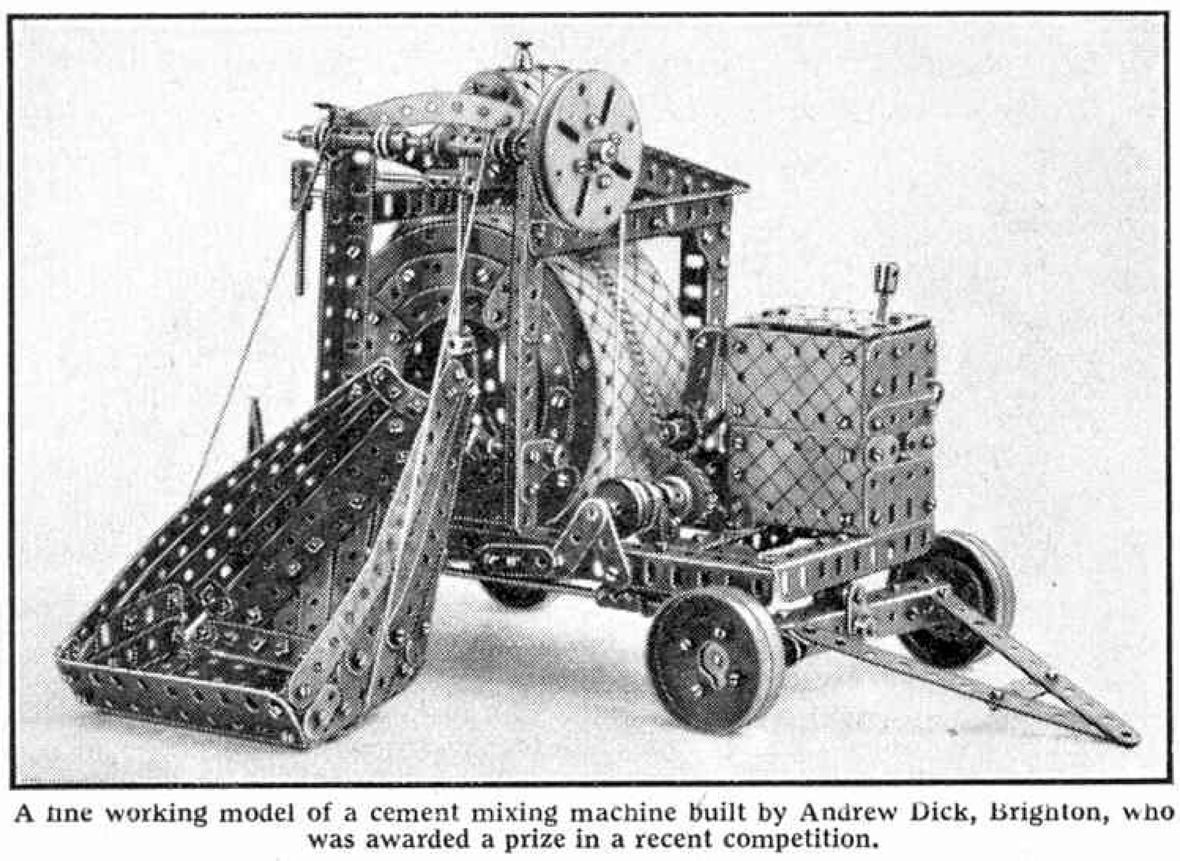
The remaining part of the model to be constructed is the boat deck. This consists of three $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plates bolted together to make a compound plate with a total length of 13 in. The three Funnels (Part No. 138a) are mounted on the deck and also six cowl ventilators built up from $\frac{1}{2}''$ Pulleys and $3''$ Screwed Rods. The lifeboats are represented by Flat Brackets bent as shown.

The completed boat deck is secured to Strip 10 by two Angle Brackets and to Plates 11 by a $\frac{3}{4}''$ Bolt.

Meccano Competitions Open To All Readers

A Great New Year General Contest

At this time of the year Meccano model-building activities reach their apex. Old Meccano boys are adding to their sets, and thousands of newcomers to the hobby have been recruited through the medium of Christmas presents! In view of this fact, and in order to ensure that every model-builder shall have an opportunity to test his skill against that of his fellow Meccanoites, we are organising another of the great general model-building competitions in which models of all kinds may be entered. The competition is open to all model-builders, and it is arranged so that no matter how young a boy may be or how small his Outfit, he will stand just as good a chance of winning one of the splendid prizes offered as older competitors with large Outfits at their disposal. We hope, therefore, that everyone who has not yet taken part in any of the "*M.M.*" competitions, and particularly those who are now enjoying the fun of Meccano model-building for the first time, will make the most of this chance to win a prize.



A fine working model of a cement mixing machine built by Andrew Dick, Brighton, who was awarded a prize in a recent competition.

Models of aeroplanes, cranes, all kinds of motor vehicles, machines and architectural subjects are all suitable for this competition, and in building their models competitors may use any size of Meccano Outfit or any number of parts. There is no age limit and Meccano users living in any part of the world can compete on equal terms.

It is not necessary to send the actual model. When it is completed it is only necessary to obtain a photograph of it, or, if this is not possible, a good drawing. Quite a small photograph will do, provided it is clear enough to show the details of the model, and neither photographs nor drawings need be prepared by the competitor himself. The model itself, however, must be the result of the competitor's own unaided efforts.

The competitor should write his age, name and full address on the back of the photograph or drawing, and enclose it, together with a brief description of the model, in an envelope addressed "*New Year Model-Building Competition*," Meccano Ltd., Binns Road, Liverpool 13.

Entries must be posted in time to reach this office not later than 31st March. Any entries received after that date will be held over for the next suitable competition.

The prizes to be awarded for the best and most interesting models received include valuable cheques and Meccano and Hornby products, and the complete list is given in the panel at the foot of this page. There is sure to be keen competition among model-builders in their efforts to win these splendid prizes, and we strongly advise all readers to set to work on their models immediately, and thus avoid the necessity to "rush" their work as the closing date draws near.

It should be noted that photographs or drawings of models that win prizes become the property of Meccano Ltd. Unsuccessful entries, however, will be returned to readers provided that a stamped addressed envelope is included for that purpose.

"The Year's Best Prize Model" Voting Contest

During 1938 illustrations of many splendid prize-winning Meccano models have appeared in the "*Contest Results*" and competition announcements pages of the "*M.M.*," and we think readers will welcome an opportunity to express their opinions in regard to their relative merits. We have, therefore, decided to arrange this Contest, in which each competitor is asked to name on a postcard: A, the prize-winning model he considers the best illustrated during 1938; B, the models that he believes will occupy the first six places in the final list when the A votes of all competitors are added together.

Only those models that have been illustrated on the "*Model-Building Contests Results*" or Meccano competition announcements pages in any of the issues of the "*M.M.*" for 1938 are to be taken into consideration in this competition. Each model referred to must be identified by giving the page and date of the issue in which the illustration appeared, the name of the model and that of its builder. If the builder's name is not stated in the caption to the illustration it will be found somewhere in the accompanying article.

Entries must be by postcard only. The competitor's name and address must be written on the card, which should be addressed to "Year's Best Prize Model" Voting Contest, Meccano Ltd., Binns Road, Liverpool 13. No competitor may submit more than one entry.

There will be one section only, and this will be open to both Home and Overseas competitors of all ages. The closing date for receipt of entries is 31st March.

The following prizes will be awarded in order of merit to the competitors whose lists most accurately forecast the final placings of the six best models, as decided by the massed A votes of all competitors: First Prize, Meccano products value £2/2/–; Second Prize, Meccano products value £1/1/–; Third Prize, Meccano products value 10/6. There will be also five prizes consisting of Meccano products value 5/–. In the event of a tie the prizes will be awarded to the most neatly prepared of the entries concerned.

"New Year" Model-Building Competition

THE PRIZES

1st Prize—Cheque for £5/5/–.
2nd Prize—Cheque for £3/3/–.
3rd Prize—Cheque for £2/2/–.
10 Prizes of Meccano or Hornby products value 10/6.
10 Prizes of Meccano or Hornby products value 5/–.
Certificates of Merit.

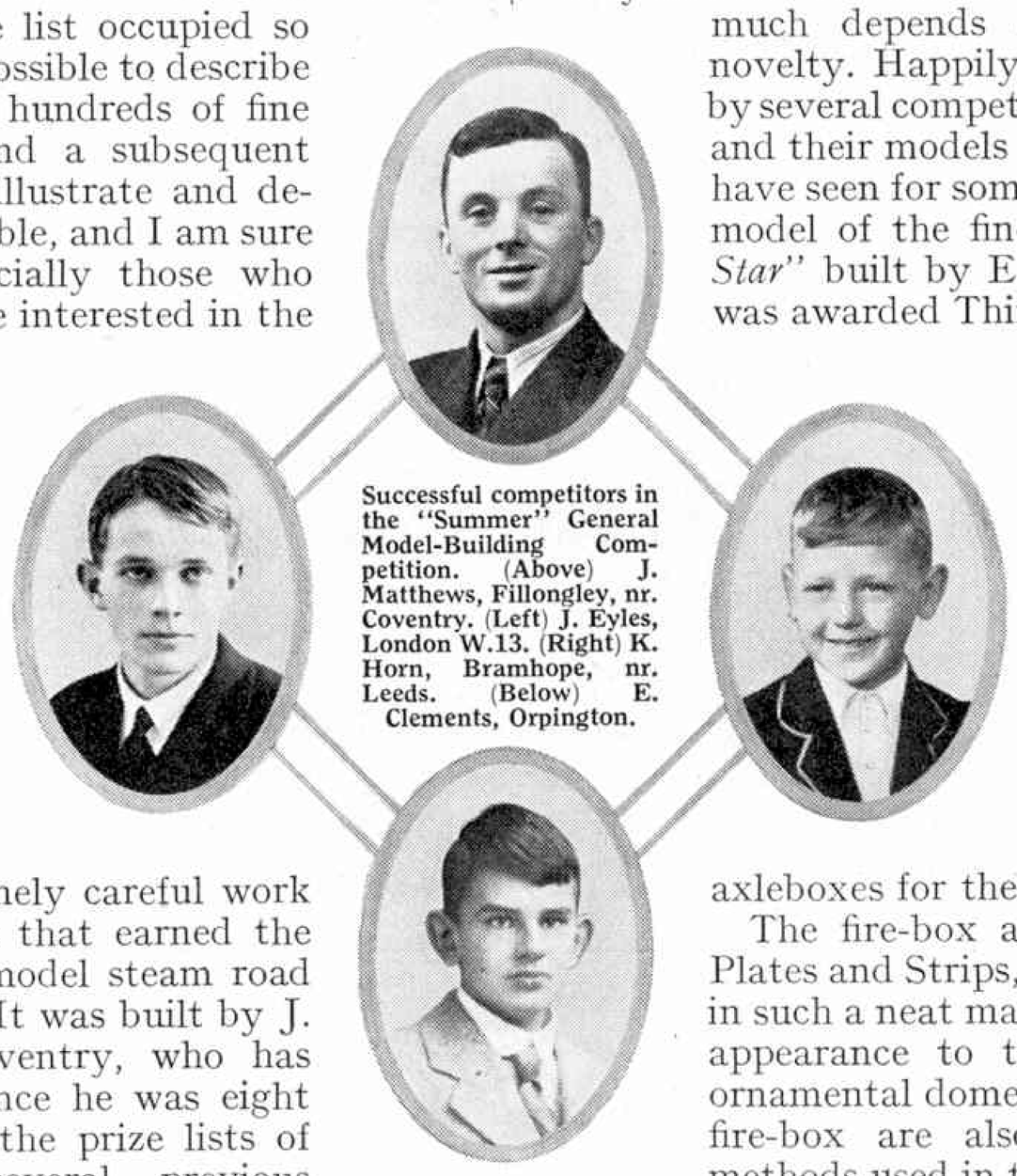
"Summer" Model-Building Competition

By "Spanner"

Details of Prize-winning Models

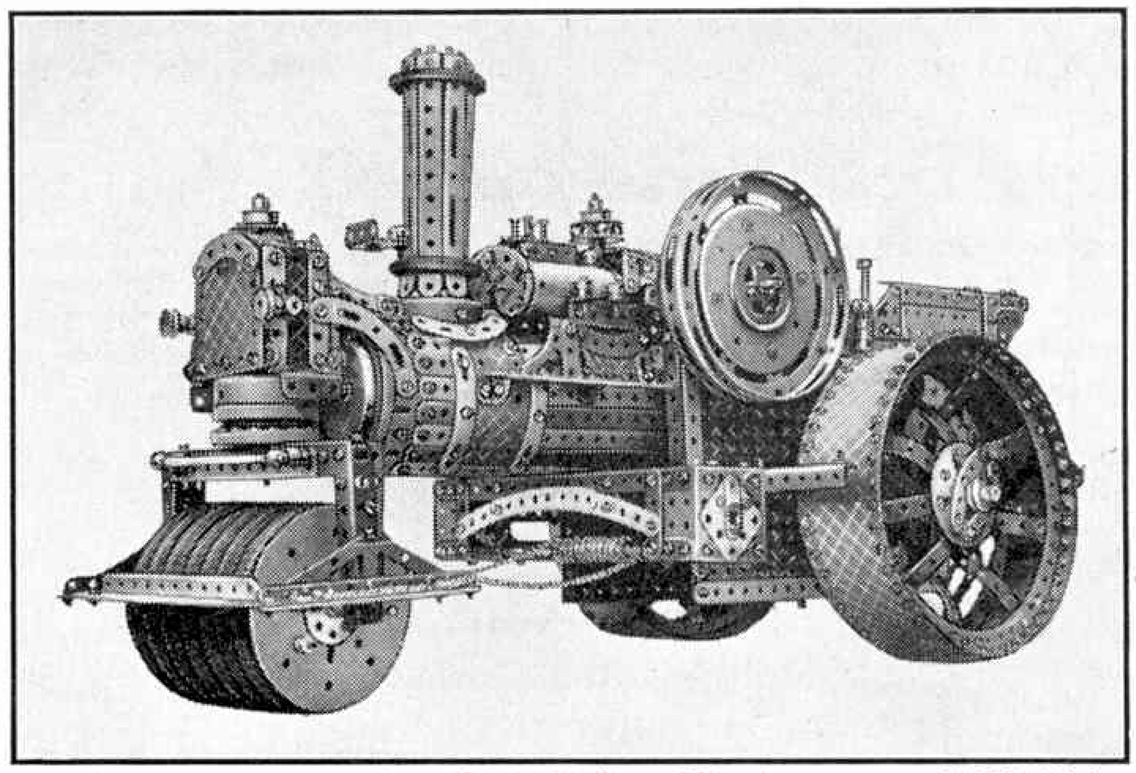
IN last month's *"M.M."* we published lists of the prize-winners in the Grand *"Summer"* General Model-Building Competition, but the list occupied so much space that I found it impossible to describe or comment upon any of the hundreds of fine models submitted. In this and a subsequent article, however, I intend to illustrate and describe as many of these as possible, and I am sure that all model-builders, especially those who took part in the Contest will be interested in the fine work done by other competitors.

The models illustrated this month are selected at random and are not dealt with in order of merit. I have adopted this system so as to give readers an idea of the variety of subjects chosen and the neatness and constructional skill that are characteristic of all the prize-winning entries. It was the presence of these features combined with extremely careful work in the carrying out of details that earned the First Prize for the very fine model steam road roller illustrated on this page. It was built by J. Matthews, Fillongley, nr. Coventry, who has been a Meccano enthusiast since he was eight years old and has figured in the prize lists of Meccano competitions on several previous occasions. He often gives the leisure time of six months to the construction of a single model, rebuilding it again and again until he is perfectly satisfied with his work.



Successful competitors in the "Summer" General Model-Building Competition. (Above) J. Matthews, Fillongley, nr. Coventry. (Left) J. Eyles, London W.13. (Right) K. Horn, Bramhope, nr. Leeds. (Below) E. Clements, Orpington.

Evidence of his patience and skill is apparent in every detail of his models. Examine, for example, the mass of detail in the steam roller, and the fine proportions of the various parts, which give the model distinction and make it outstanding even among the many praiseworthy models that were entered in this competition. The illustration is worthy of very careful examination, for few model-builders will fail to find in it constructional ideas that will be helpful in their future work.



The model steam road roller for which J. Matthews, Fillongley, was awarded First Prize.

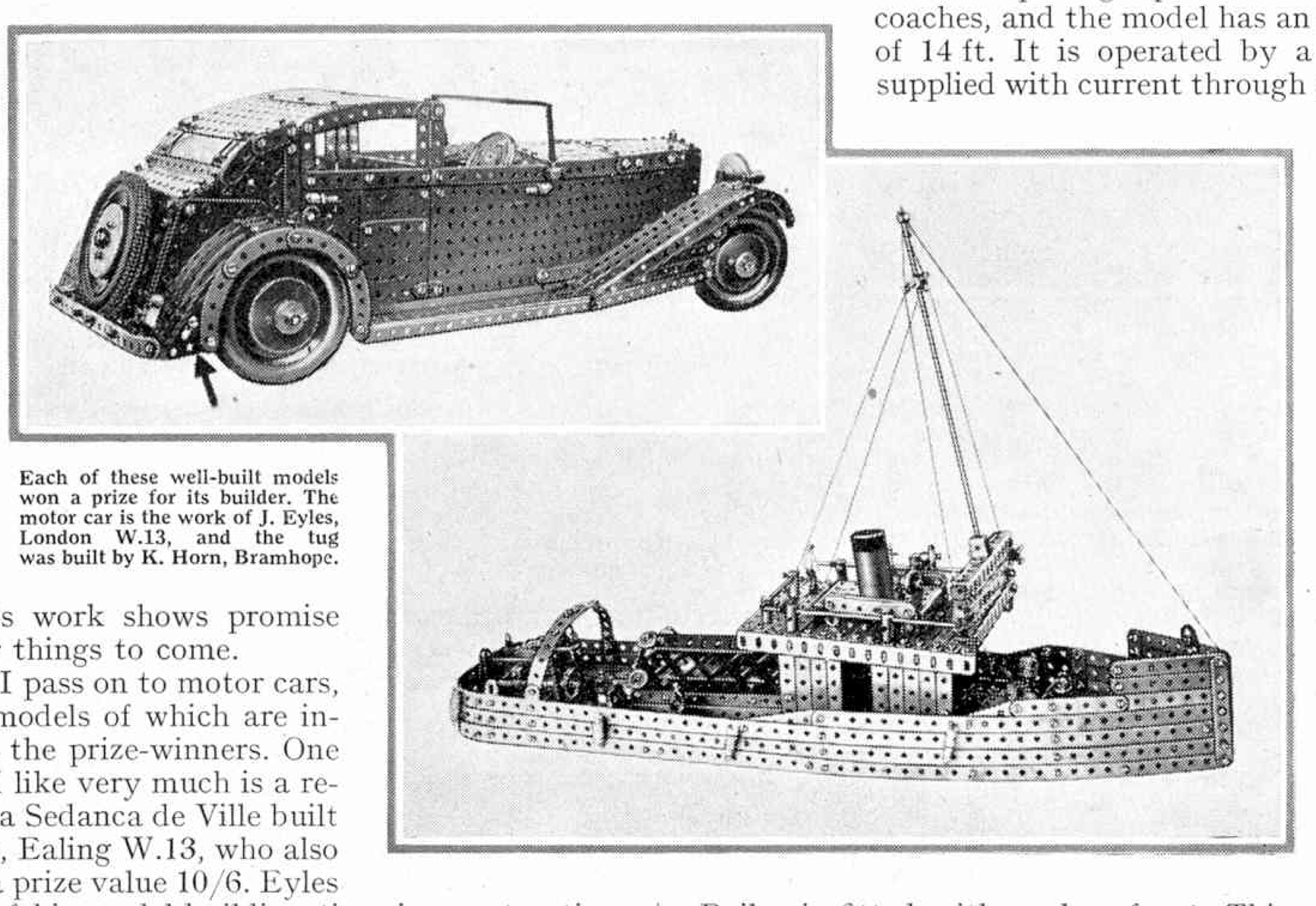
As is usually the case in Meccano competitions, model locomotives were prominent among the prize-winning entries in the *"Summer"* Competition. Locomotives are very fine subjects for models, but owing to their great popularity, models of this kind must be constructed in an original manner if they are to be successful in open competitions, in which so much depends on freshness of subject and novelty. Happily these conditions were fulfilled by several competitors in the present competition, and their models are the best of their kind that I have seen for some time. A typical example is the model of the fine old G.W. locomotive *"North Star"* built by E. D. Clements, Orpington, who was awarded Third Prize. The model is shown in the lower illustration on the opposite page, and the more one examines it, the greater the impression of realism it creates. This is due partly to the careful attention its builder gave to the various details, but mainly to the excellent proportions of the wheels, boiler and chimney. Constructionally the model has many points of interest, notably the hornplates and axleboxes for the driving wheel journals.

The fire-box and boiler are built from Flat Plates and Strips, and these have been assembled in such a neat manner that they give a very solid appearance to the model. The chimney, the ornamental dome, and the manhole cover on the fire-box are also pleasing and the different methods used in their construction are worthy of note. The manhole cover consists of two 3" Pulleys surmounted by a Wheel Flange, and a cylinder of $1\frac{11}{16}$" Curved Plates clamped between 3" Pulleys and Wheel Flanges is used for the dome. The chimney is built from $7\frac{1}{2}$" Strips.

Clements has been a model-builder for some years, and has won several prizes in Meccano competitions. He tells me that his real interest in Meccano started when he tried to build a detailed model of the gas cooker at his home. He found the task so fascinating that Meccano has continued to be his chief indoor pastime. Clements is also a keen astronomer, and readers will perhaps remember the fine model of a meridian telescope built by him that was illustrated in the November *"M.M."*

The ages of the competitors in this competition ranged from $8\frac{1}{2}$ years to 45 years, and in judging the models each competitor's age and model-building experience was

taken into consideration as far as possible. Many of the younger boys sent in work that would have done credit to model-builders of twice their age, and among these was Kenneth Horn, Bramhope, Nr. Leeds, who built the sturdy little tug shown on this page. It will be seen that Horn chose the parts he used with great care. He was awarded a prize value 10/6, and I hope his success in this Contest will encourage him to continue his efforts, for his work shows promise of even better things to come.

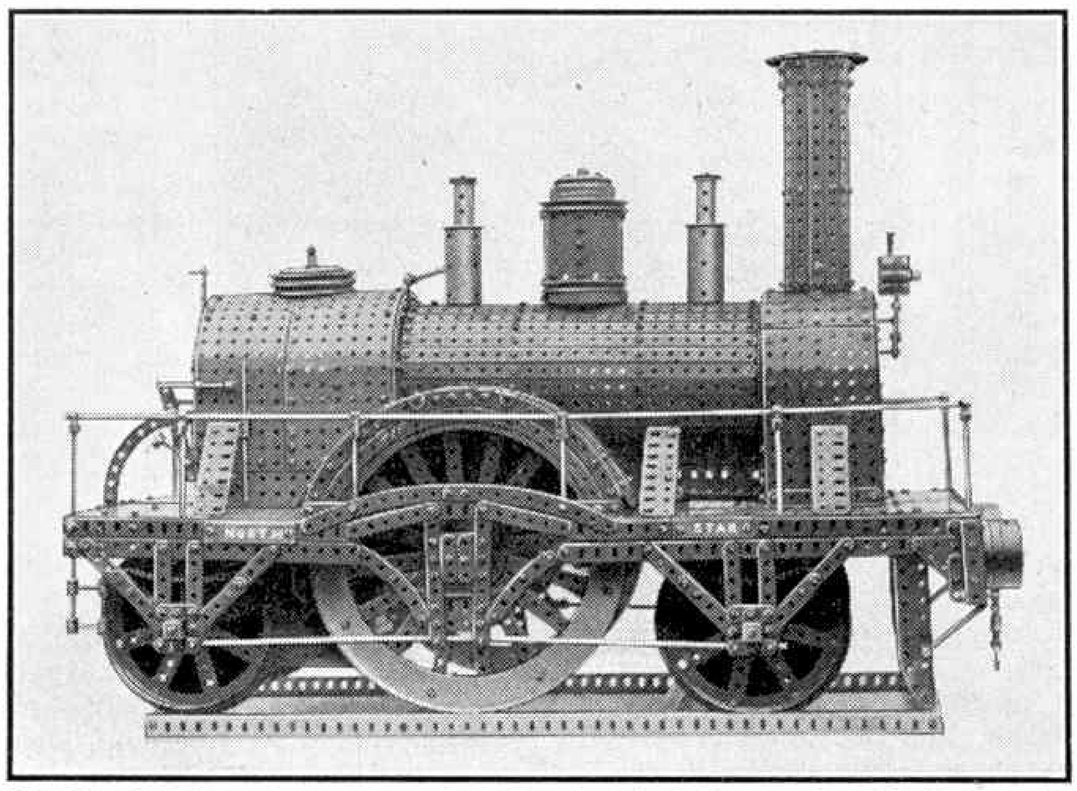


Each of these well-built models won a prize for its builder. The motor car is the work of J. Eyles, London W.13, and the tug was built by K. Horn, Bramhope.

From ships I pass on to motor cars, several good models of which are included among the prize-winners. One of these that I like very much is a reproduction of a Sedanca de Ville built by J. F. Eyles, Ealing W.13, who also was awarded a prize value 10/6. Eyles spends most of his model-building time in constructing cars of various types, and the large stock of Meccano parts he has gradually accumulated enables him to model them down to the smallest details. His Sedanca de Ville, illustrated on this page, is a typical example of his work, and displays a sound knowledge of the use of Meccano parts. The rear of the car is particularly good, the moulding of the curved body being carried out in a very neat manner. Unfortunately this feature is not shown very clearly in the illustration. The chassis is fitted with a 6-volt Electric Motor and transverse front springs; the rear springs are of the semi-elliptic type. Ackermann steering gear is incorporated, and is so arranged that the complete movement from full left lock to full right lock is accomplished by slightly more than two turns of the steering wheel.

Eyles is now building a revised version of this model, which is fitted with an H-gate gear box and front wheel brakes. He tells me that, although Meccano model-building is his chief hobby, he still finds time for operating a big Hornby Train layout and sailing model ships. He hopes to enter the engineering profession when his school days are ended, and I have no doubt that the knowledge of engineering principles he is gaining while indulging in Meccano model-building will prove of great value to him in his chosen career. I shall look forward to seeing further examples of his work in future competitions.

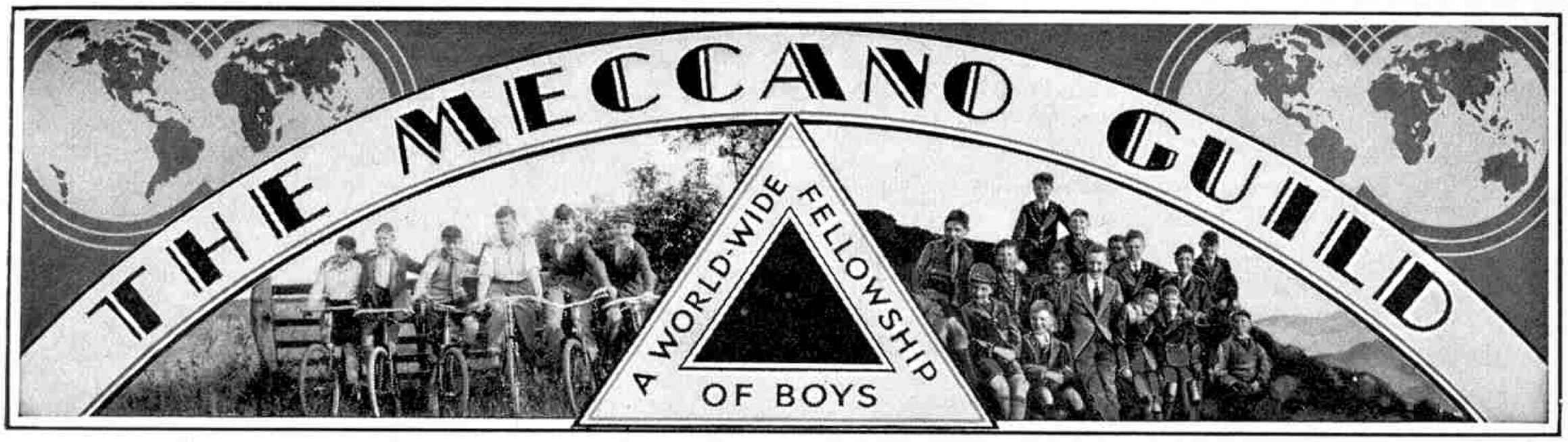
Third Prize was awarded to H. G. Shorten, Winnipeg, Canada, for one of the most neatly-built models of an American streamlined train that I have seen. The subject is the pioneer streamlined train of the Union Pacific Railroad, comprising a power car and two trailer coaches, and the model has an overall length of 14 ft. It is operated by a 6-volt Motor supplied with current through a Transformer housed in the power car. The train carries a headlight, and each coach is fitted with electric lights. The construction of the headlight is rather unusual, for it consists of a Boiler lined with white cardboard and fitted with a bulb set at the rear end. The other end of the Boiler is fitted with a glass front. This system of construction enables a strong beam of light to be thrown ahead of the train, and the model is very striking and impressive when in motion, with all the coaches brilliantly illuminated. All the lights are operated from dry batteries, those supplying the headlight being housed inside the power car, while each coach carries a battery under the chassis and is provided with a switch.



The historical G.W. locomotive "North Star" realistically reproduced in Meccano by E. Clements, Orpington, who was awarded Third Prize.

In view of the great weight of the model the drive from the Motor is transmitted through a reduction gear-box arranged as follows. A $\frac{3}{4}$" Pinion on the Motor shaft meshes with a 50-teeth Gear Wheel mounted on a Rod that carries also a $\frac{1}{2}$" Pinion. The latter engages a $3\frac{1}{2}$" Gear Wheel on a Rod that carries also a $\frac{3}{4}$" Bevel Gear in mesh with a second Bevel on a vertical shaft. The lower end of the vertical shaft is fitted with a $\frac{1}{2}$" Bevel that meshes with a $1\frac{1}{2}$" Bevel on one of the driven axles of the power car. The drive is then transmitted to a second axle of the car by Sprocket Chain.

One or two models of textile machines usually are included among the entries in "*M.M.*" general competitions, and in the "*Summer*" Contest a model of this kind won a prize for G. Bruce, Heckmondwike. The model represents a motor-driven wool carding machine, and is based on actual machines used in Yorkshire mills. It is a good piece of work, but the photograph submitted is rather blurred and the details of the mechanism are not easy to follow.



New Year Greetings

It is with great pleasure that I wish every member of the Meccano Guild, and everyone connected with Meccano clubs, a very bright and prosperous New Year. My friends in all parts of the World never allow me to forget the approach of New Year's Day, and for days my mail bag has been almost filled with greetings for 1939 from them. I send my warmest thanks to all who have written to me, and indeed to everyone who has given the least thought to the Guild and to the members of its staff, who devote so much time to writing to Meccano boys and generally do all they can to encourage and assist them.

A Record Year in 1939

And now we plunge into another year of activity. I have made up my mind that 1939 is to be a record year, if only because in October the Guild will celebrate its 20th birthday. It seems to me that the best way of celebrating an event of this kind will be to stir up enthusiasm generally among existing members, and to enrol every Meccano boy who has not yet joined. In this aim every individual member must play a part by making sure that his friends at school and elsewhere join if they have not already done so, and club members can do their share by taking new boys to club meetings, so that they can join in the fun. The result will be not only a record year, but also a splendid start for the even more important year that is to follow, in which the Guild will come of age.

I have no doubt in my own mind that 1939 will be a splendid year, for in the past few months there has been a spurt in Guild membership and gratifying increase in club activities. There is no reason why both should not be speeded up. New readers of the Magazine, and all boys who have just now for the first time joined the happy band of Meccano owners, whatever their ages, should join the Guild. If they have not got the necessary forms by them they have only to send a postcard to the Secretary, Meccano Guild, Binns Road, Liverpool 13, when copies will be sent to them immediately. They cannot make the most of their hobby until they have become Guild members and are writing regularly to tell me about their models, or to ask questions about anything in which they are interested. Even then they should meet other Meccano boys, and for this reason should join a club or try to form one if there are none within easy reach.

Turning now to the clubs, I want to give a special word of encouragement to the small and struggling organisations, consisting of perhaps a few enthusiasts who meet at each other's homes regularly to build models or to enjoy running their Hornby Trains together. I am as interested in these as in the big affiliated clubs, most of which themselves were once in a similar position. Every club, however small and whether affiliated or not, should take care to send me regular reports so that I can publish them in "Club Notes." There they will attract the notice of possible new members and supporters, and so will be a useful means of strengthening the club.

Meccano Club Leaders

No. 96 Mr. G. Mantovani

Mr. G. Mantovani is President as well as Leader of the Milan M.C., which was affiliated in February 1934. During its long career this successful Italian club has made special features of sports, including football, and film displays. Mr. Mantovani also is President of the associated Milan Branch, No. 274, of the H.R.C., and under his energetic guidance new activities are being introduced in both organisations.

Correspondence Between Clubs

One way in which clubs could make this year memorable would be by taking a greater interest in other clubs. Members of different organisations meet only on special occasions, such as the now famous rallies of Devonshire clubs in the early part of 1938. Distance and expense prevent more gatherings of this kind, but there is no reason why there should not be regular correspondence between clubs. This is far more effective in creating a friendly feeling than is perhaps realised. For instance, there is a regular exchange of letters between Mr. V. Malmgreen, of the Maylands club, in Western Australia, and Mr. J. Ancall, of Christchurch M.C., New Zealand, and the correspondence has been very helpful in club work to both of these highly successful Leaders.

Another example of good work of this kind comes from nearer home. Mr. S. McCready, the founder and Leader of the Islandmagee M.C. in Northern Ireland, was in regular correspondence with Mr. M. C. Hodder, Leader of the Exeter club, during the early days of his own club, and Mr. Hodder's experience no doubt played a great part in encouraging the founder of the Islandmagee club to go forward with his good work, which has aroused wide interest and has been particularly well described and praised in the local press. Mr. McCready is in correspondence also with Mr. W. J. Ellis, Leader of the Plymouth M.C., and a scheme is being worked out to enable members of the two clubs to write to each other.

This practice could well be encouraged in every club throughout the world. Club officials wishing to join in the scheme should write to me immediately, so that I can make the necessary arrangements for them. When doing so they should tell me which club they would prefer to get in touch with, or the country in which they would like their club correspondents.

Proposed Clubs

Attempts are being made to establish Meccano clubs in the following places, and boys interested should communicate with the promoters, whose names and addresses are given below:

CANADA—D. Fishbourne, 9556—82 Avenue, Edmonton, Alberta, Canada.
CORK—M. Connell, 105, Lower Road, Cork City.
DAGENHAM—H. Bryant, 114, Broad Street.
GLASGOW—R. McKenzie, 15, Gelston Street, Sandyhills, Glasgow E.2.
HEMEL HEMPSTEAD—H. Elms, 14, Manorville Road, Apsley End.
LEIGH-ON-SEA—G. Trory, 27, Lindisfarne Avenue.
SHIRLEY—K. Seymour, 5, Branksome Avenue, Shirley, Southampton.
SOUTHBOURNE—A. Viney, 136, Castlemain Avenue, Southbourne, Bournemouth.
WATFORD—A. Ramsbottom, 11, De Vere Walk, Langley Way.
WITNEY—D. Luckett, New Shifford, Witney, Oxon.

Holy Trinity (Mildmay) M.C.—During the past months the club has passed through a very strenuous period, but it is now, due to the untiring work of its Leader, in a very favourable position. Through the courtesy of Dr. Cochrane it has acquired a new hall at Mildmay Centre, Stoke Newington Road, N.1. The hall provides much more scope for increasing the membership and executing of many plans. Membership has been well maintained, and work is nearing completion for the proposed Exhibition, which is to be held on 17th and 18th February at the new hall. Club roll: 20. *Secretary:* H. C. Boys, 37, Mackenzie Road, Beckenham, Kent.

Mallow M.C.—Operations were suspended during the summer months owing to the absence of the Leader on business, but now he has returned to the club and excellent progress is being made in all directions. Great interest is being taken in model aeroplanes, and a model aerodrome has been constructed, complete with control tower and hangars. An A.R.P. set is now in preparation for the defence of "Meccano City," and when this is complete a model pre-war aerodrome is to be constructed. Club roll: 8. *Secretary:* D. Hickey, 42, Ballydakeen, Mallow, Co. Cork, Eire.

Winchmore Hill Collegiate School M.C.—Excellent cut-out calendars were made at a Handicrafts Meeting, a prize being awarded for the neatest production. A successful all-comedy Film Show was thoroughly enjoyed, and a Lantern Lecture given by Mr. C. Drakes, Chairman of the club, on "*All Night with the London Transport*" aroused a great amount of interest. Another attractive feature was a Shunting Competition, which enabled members to show their skill in railway matters. Club roll: 28. *Secretary:* F. J. Hearn, 143, Conway Road, Southgate, London N.14.

Bishop Road Boys' School (Bristol) M.C.—Meetings have been held weekly, and models of varied interest have been brought for examination and criticism by other members of the club. Visits to the docks have been arranged. The programme to be followed includes the examination of models on loan, and various competitions. Club roll: 45. *Secretary:* R. Bellew, Bishop Road Boys' School, Bristol 7.

Northampton M.C.—The Meccano Section of the Northampton Branch of the Hornby Railway Company is now in full swing. At the first meeting a Crane Contest was held. Entries had to be built of 50 parts, and several interesting models of various types of mobile, hammerhead and travelling cranes were made. A Games Night was held in conjunction with the associated Branch. Much interest was centred on a miniature football game kindly loaned by Mr. J. Southwell, for which a "knock-out" competition has been arranged. Club roll: 8. *Secretary:* E. F. Billingham, 187, Birchfield Road East, Northampton.

Hele's School (Exeter) M.C.—Owing to the limited facilities available meetings can only be held once a week, but full advantage is taken of these opportunities. Instructive lectures have been given by members, and these have been illustrated by means of an epidiascope. Model-building plays an important part in the club's programme, and outstanding models have been a mechanical horse and trailer, a cantilever bridge and a representation of the Ei el Tower. A Table Tennis Tournament has been held. It is hoped to arrange an Exhibition in conjunction with certain other School Societies. Club roll: 10. *Secretary:* Mr. M. E. Leach, 61, West Grove Road, Exeter.

Plymouth M.C.—The "Richard Tubb" Cup was exhibited at the club room. It is awarded for the best recruiting effort of the year, and for 1938 has been won by D. Dare. Owing to the departure of Mr. R. Symons, former secretary of the club, who edited "*Shipping Notes*" in the club's magazine, "*The Gearbox*," a new contributor was required and G. Collins has filled the vacancy. Membership is increasing and there have been record attendances. Mr. Emdon is endeavouring to inaugurate a New Club Library, and he will be very glad to receive as many books as possible. Club roll: 81. *Secretary:* A. E. Miller, 21, Hamilton Gardens, Mutley, Plymouth.

Burnley Grammar School M.C.—Model-building continues to be a very popular feature of the club programme, and preparations are already in hand for a Hobbies Exhibition, which is to be held in April next. A model of the Forth Bridge has been built for this event, and it is proposed to construct Meccano ships and other models on the same scale to place around or on it, in order to give the impression of a busy river scene. Club roll: 16. *Secretary:* L. H. C. Hawkins, 27, Carlton Road, Burnley, Lancs.

Great Baddow M.C.—The four club teams have been reformed, and each is constructing one large model. Indoor games were greatly enjoyed on one evening, and another meeting took the form of a Road Traffic Night under the supervision of Mr. Rawlingson, with members trying to pass "driving tests." A Talk on "*Aircraft*," also given by Mr. Rawlingson, proved very interesting. Club roll: 24. *Secretary:* K. J. Avis, 3, Crescent Road, Great Baddow, Chelmsford.

St. Stephen's M.C.—The Exhibition held in November in conjunction with the associated Branch of the H.R.C. was very successful. Attractive programmes gave full particulars of the various exhibits, with the names of those who were responsible for their construction or operation. The Model-Building Section produced eight excellent models, and various other ingenious models were contributed by individuals, a Cruising Cutter constructed by Mr. C. Doidge calling for particular attention. Other contributions were a Model Inn and Farmyard, and a Wakefield Cup model aeroplane, which has flown for six and a half minutes. The Mayor, who opened the Exhibition, was presented with a sailing ship model, and Merit Medallions were presented to Mr. R. Saunders and Mr. B. Braund. Club roll: 12. *Secretary:* B. Braund, 9, Homer Park, Saltash.

Barnard Castle School M.C.—Many recent meetings have been devoted to track operations on the club's Hornby railway, and timetables are now in operation. As there are so many locomotives of the same type it has been decided to run services. There has been a great deal of activity on the part of the Meccano Section. Membership is steadily increasing, many of the newcomers bringing along new Meccano Outfits that have greatly increased the club's resources. Club roll: 12. *Secretary:* A. Coates, Barnard Castle School, Barnard Castle, Co. Durham.

A group of members of the Sharkia Province M.C., with Mr. M. F. Adb-El-All, Leader, standing in the centre, and M. Z. A. Fuad, secretary, on his left. This Egyptian club was affiliated with the Guild in July of last year and has made excellent progress. Meetings in the club room are held weekly, and a special feature is made of visits to works and places of interest, including trips in the desert to see ancient monuments.

Exeter M.C.—Rapid progress and development have been striking features of recent meetings, which has resulted in the formation of a very strong Senior Section. Football continues to be a popular feature of the club's programme, but this has not interfered with other activities, and the club has produced many excellent Meccano models. A Guild member from Malta visited the club recently, and a special reception meeting was called. Club roll: 65. *Secretary:* J. T. H. Fenwick, 45, Calthorpe Road, Exeter.

Middlesbrough M.C.—Splendid progress continues to be made, and membership is rapidly increasing. A special Entertainment Evening proved enjoyable, many of the new members showing so much talent that it was decided to hold a similar event the following week. Altogether a very prosperous and successful future is anticipated for the club. Club roll: 20. *Secretary:* G. Brockhurst, 49, Heythrop Drive, Acklam, Middlesbrough.

Regent Street Central School (Heywood) M.C.—A very attractive programme has been drawn up to cover meetings until July. Lantern Lectures are a special feature, and these cover a wide range of interesting subjects. An Exhibition and Concert were held in November in aid of club funds, and both events proved very successful. Other outstanding items that have been arranged are a Gymnastic Display by boys and girls, a Concert and Boxing Exhibition, an Exhibition of Models, Visits to places of interest and a Parents' Day and Exhibition. Club roll: 150. *Secretary:* L. Mathews, 2, James Street, Heywood, Lancs.

Queen Elizabeth's Grammar School (Barnet) M.C.—Two Lantern Lectures have been given, one on the "*Nature Lover's London*" by courtesy of the London Passenger Transport Board, and another on "*Pit Work and Control*" by Mr. S. C. H. Davis, Sports Editor of the "*Autocar*." Visits have been paid to the works of the Anglia Match Co. Ltd. and Scammell Lorries, Watford. Club roll: 25. *Secretary:* Mr. R. I. E. Haynes, 127, Hadley Road, New Barnet.

Mount Senior School M.C.—Excellent progress continues to be made in the club, and meetings are now being held regularly. A trip to York under the guidance of Mr. Beard, Leader, proved particularly enjoyable and instructive. Club roll: 51. *Secretary:* A. Kemp, Over Barclays Bank, 27, Stodman Street, Newark.

EGYPT

Zagazig and Misr M.C.—The club celebrated its third birthday by a very enjoyable party. Many visits to various places of interest have been made, and a Surprise Outing proved particularly enjoyable. Model-building is the chief feature of indoor meetings. The Woodwork Section has been extremely busy making cupboards in which to store the club's stock of Meccano parts. An illustrated Lecture given by the President on Electric Traction proved very interesting. Club roll: 24. *Secretary:* A. S. Mangourie, 13, Sharia Badir, Zeitoun, Cairo, Egypt.

NEW ZEALAND

Christchurch M.C.—Excellent progress continues to be made in the club, and membership is rapidly increasing in both sections. Visits are still being paid once a fortnight to the Deaf and Dumb School at Sumner. A Debate on "*Railways v. Road Transport*" proved very interesting, Mr. E. A. Gay acting as judge. The result was a draw, as it was decided that both means of transport were necessary to each other. The Inter-Club Shield, offered for competition for the first time last year, is held by the club, and not by the Ashburton M.C., as stated in error in the September 1938 "*Club Notes*." Mrs. Cordey, who has just returned from abroad, gave an interesting account of her experiences, and members were so thrilled that it was unanimously decided to invite her to give another talk. Club roll: 36. *Secretary:* S. S. Stringer, 250, Oxford Terrace, Christchurch C.1, New Zealand.

SOUTH AFRICA

Malvern M.C.—A very successful Fete was held in November last. The proceeds, amounting to £20, were devoted towards the purchase of Christmas presents for the Epworth Children's Homes. Talks and Short Stories are very popular features of the club's attractive programme, and a Debate on "*Alcohol—For and Against*" proved of great interest. Mr. Fuhri gave a talk on "*First Aid*," and a suggestion that club members should take the subject up is to be considered. Mr. Sykes has now resumed leadership of the club. Club roll: 35. *Secretary:* Miss M. Morrison, 462a, Jules Street, Malvern, Johannesburg, South Africa.

Join THESE WORLD-WIDE FELLOWSHIPS OF HAPPY BOYS

PRESIDENT:
MR. ROLAND G. HORNBY

HORNBY RAILWAY COMPANY

A real railway company with boy directors and officials

How to become a Member

Every boy who possesses a Hornby Train Set should join the Hornby Railway Company and thus become entitled to wear the badge of membership, which is beautifully enamelled in colours and has as its central feature a tiny representation of a train. All that he has to do is to fill in the application form—a copy of which is enclosed in every Train Set, or may be obtained from the Secretary, Hornby Railway Company, Binns Road, Liverpool 13—and return this, together with a remittance of 6d. (Overseas 10d.) to pay for the badge. Immediately on receipt of the completed form the applicant is enrolled as a member of this great organisation, and a handsome certificate to that effect is forwarded to him along with his badge.

The chief aim of the Company is to enable its members to get as much fun as possible from their miniature railways. This can best be done by helping them to make their layouts, and their railway operations generally, as realistic as possible, and competent railway experts on the staff at Headquarters are continuously engaged in advising members how to make the best use of the material at their disposal.

Join a Local Branch

The greatest fun is obtained from Hornby Trains by joining one of the many local Branches that have been formed in various parts of this and other countries. These Branches are composed of Hornby Train owners who meet together in order to carry out railway operations on a more extensive scale than is possible for a single individual. Every member should join a Branch, or if one does not exist in his neighbourhood, he should try to induce other enthusiasts to help him to found one.

MECCANO GUILD

THE MECCANO GUILD

BADGE OF MEMBERSHIP

To help and encourage Meccano boys

The Meccano Guild is an organisation for boys, formed with the object of making their lives brighter and happier—and of encouraging them in the pursuit of their studies and hobbies. All owners of Meccano Outfits are eligible for membership. Each member has the personal interest of the President and is entitled to the friendly advice and assistance of the Secretary. He wears the triangular Meccano Guild badge, beautifully enamelled in blue and white, and is presented with a handsome membership certificate printed in orange and black, and undertakes to promote the great objects of the Guild.

How to Join

All that is necessary to join the Guild is to fill up the form of application enclosed in all Outfits, and forward it to the Secretary, Meccano Guild, Binns Road, Liverpool 13, together with a remittance of 7d. (Overseas 1/–, Canada 25 cents) to pay for the badge. The applicant is then duly enrolled and his certificate and badge of membership are sent to him. If desired, application forms can be obtained from the Secretary.

Boys living overseas should write to one of the Meccano agents at the following addresses: CANADA: Meccano Ltd., 187-189, Church St., Toronto. AUSTRALIA: Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W. NEW ZEALAND: Models Ltd., Third Floor, Paykel's Buildings, 9, Anzac Avenue (P.O. Box 129), Auckland, C.1. SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.

Meccano Clubs

Meccano Clubs are founded and established by enthusiastic Meccano boys under the guidance of the Guild Secretary at Headquarters. Every Guild member should join one if possible, for only in association with other Meccano boys is he able to obtain the greatest fun from his hobby. If the nearest club is too far away for him to join, he should consider the possibility of forming a new club in his own district. A special booklet entitled **"How to Run a Meccano Club"** is now ready, and will be sent (post free) to any reader on receipt of 2d. in stamps.

H.R.C. Branch News

ISLINGTON.—Regular track meetings are being held, and efforts are being made to improve train running. One member has devised an interesting system of code lights that can be substituted for telephonic communication during Exhibitions. Secretary: J. H. Cronin, 1, Aubert Park, Highbury, London N.5.

EDGBASTON.—The track has been placed on baseboards raised off the floor. All equipment has been thoroughly overhauled. Members visited the Birmingham section of the London and Birmingham Railway Centenary. Operations have been commenced on the new track, and the running of passenger and goods trains has been successfully reproduced. A visit has been arranged to the Leicester L.M.S. Motive Power Depot. Secretary: R. L. Teare, 531, City Road, Edgbaston, Birmingham 17.

WHITGIFT SCHOOL (CROYDON).—Interesting track working, competitions and other activities have been enjoyed. A Lecture by the secretary on *"Present-day Locomotives of the G.W.R.,"* illustrated by an epidiascope, was greatly enjoyed. Members visited the local fire station and inspected up-to-date fire-fighting equipment, including the latest foam apparatus, asbestos suits and A.R.P. trailer pump equipment. A Lecture is to be given on *"The Southern Electrics."* Outings have been arranged to the L.M.S. Motive Power Depot at Camden, and the G.W.R. Sheds at Old Oak Common. Secretary: G. G. Caddy, 14, Culmington Road, South Croydon, Surrey.

ROCKPORT SCHOOL.—Train running has been carried out on the Branch layout, which has double track, with a siding and goods yard, and terminal and wayside stations. Efforts are being made to improve the design of the layout, and so obtain more efficient running. It is also hoped to fix up some means of illumination for the layout. The working of the *"Riviera Blue Train"* has proved of special interest. Secretary: P. C. L. Cosgrave, Rockport School, Craigavad, Co. Down.

ROSEDALE (KIDDERMINSTER).—This Branch, formerly the Swan (Kidderminster), recently changed its headquarters, and meetings have been occupied with the preparation of the new clubrooms and the relaying of the track. This has now been completed and timetable train running resumed. Attention is being given to the scenic details of the layout, in which Dinky Toys are incorporated. Evenings are to be arranged for darts, Corinthian bagatelle and other games. It is hoped to hold a Parents' Night Exhibition some time this month. Secretary: L. A. D. Hamblin, 11a, Swan Street, Kidderminster.

SOUTH WOODFORD.—The first general meeting of this recently-incorporated Branch was devoted to a discussion regarding the programme. At the opening track meeting a layout design was worked out, and the laying of the track has now been commenced. Rolling stock has been thoroughly overhauled, and the pulling power of each locomotive ascertained by tests. Games Evenings are to be introduced shortly. Secretary: D. A. Cook, 22, Elmhurst Drive, South Woodford, London E.18.

FISHPONDS (BRISTOL).—An excellent locomotive stud and set of rolling stock is in use, and a high standard of efficiency has been maintained in track working. The layout is raised to a height of 1 ft. 6 in. from the ground, and covers an area of 21 ft. by 14 ft. 6 in. It is electrified and comprises three tracks, an outer one of Hornby Solid Steel rails and two inner ones of Hornby Tinplate Double Track, with several single branch lines. Accessories also are electrically lighted. Several G.W.R. corridor composite coaches have been fitted with slipping apparatus. A 12-road hump marshalling yard is to be laid down for goods traffic at "Bristol." Arrangements are being made for talks by railwaymen on various branches of working in actual practice. Secretary: A. N. Ewing, 154, Thingwall Park, Fishponds, Bristol.

ULVERSTON.—The stations on the Branch layout have been re-named "Rakehead Central," "Mayvale" and "Dustbin Halt," and a semaphore signalling system with lever frame has been erected at "Mayvale." Automatic colour-light signalling has been installed on one section of the track. A goods yard is being planned. Duties for track operations have been allotted to members, and time-tables experimented with. Secretary: J. H. Pursey, "Withersden," Rakehead, Ulverston.

PURLEY COUNTY SCHOOL.—Owing to a considerable increase in membership it has been possible to carry out track workings on a more extensive scale. One evening was devoted to the thorough cleaning of all rails. A Lantern Lecture proved very interesting. Secretary: D. Hardwick, "Woodcroft," Beech Drive, Kingswood, Surrey.

Members of the Ardsley Branch, No. 309, with Mr. H. Hill, Chairman, who is second from the right in the back row; secretary, J. A. Bell. The Branch was incorporated in June 1936. Members have built a shed for use as a clubroom, and in it have laid down steel track to form an extensive layout representing the Sheffield-Leeds line, on which regular passenger and goods services are run strictly to timetable.

Proposed Branches

The following new Branches of the Hornby Railway Company are at present in process of formation, and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given below.

ACOCKS GREEN—G. D. Cassidy, 113, Oxford Road, Acocks Green, Birmingham 27.
BANSTEAD—J. Harding, "Hard Courts," The Drive, Banstead, Surrey.
THORNE—R. Sayles, 96, King Edward Road, Thorne, nr. Doncaster.
LONDON—C. P. Wareham, 1, Solent Road, London N.W.6.
ENFIELD HIGHWAY—L. King, 73, Jasper Road, Enfield Highway, Middlesex.
STAINES—B. B. Collins, "Verutha," 153, Petersfield Avenue, Staines, Middlesex.
CANADA—Mr. T. Patterson, 5607, Queen Mary Road, Hampstead, Montreal.
CORK—M. Connell, 105, Lower Road, Cork City, Eire.

Branch Recently Incorporated

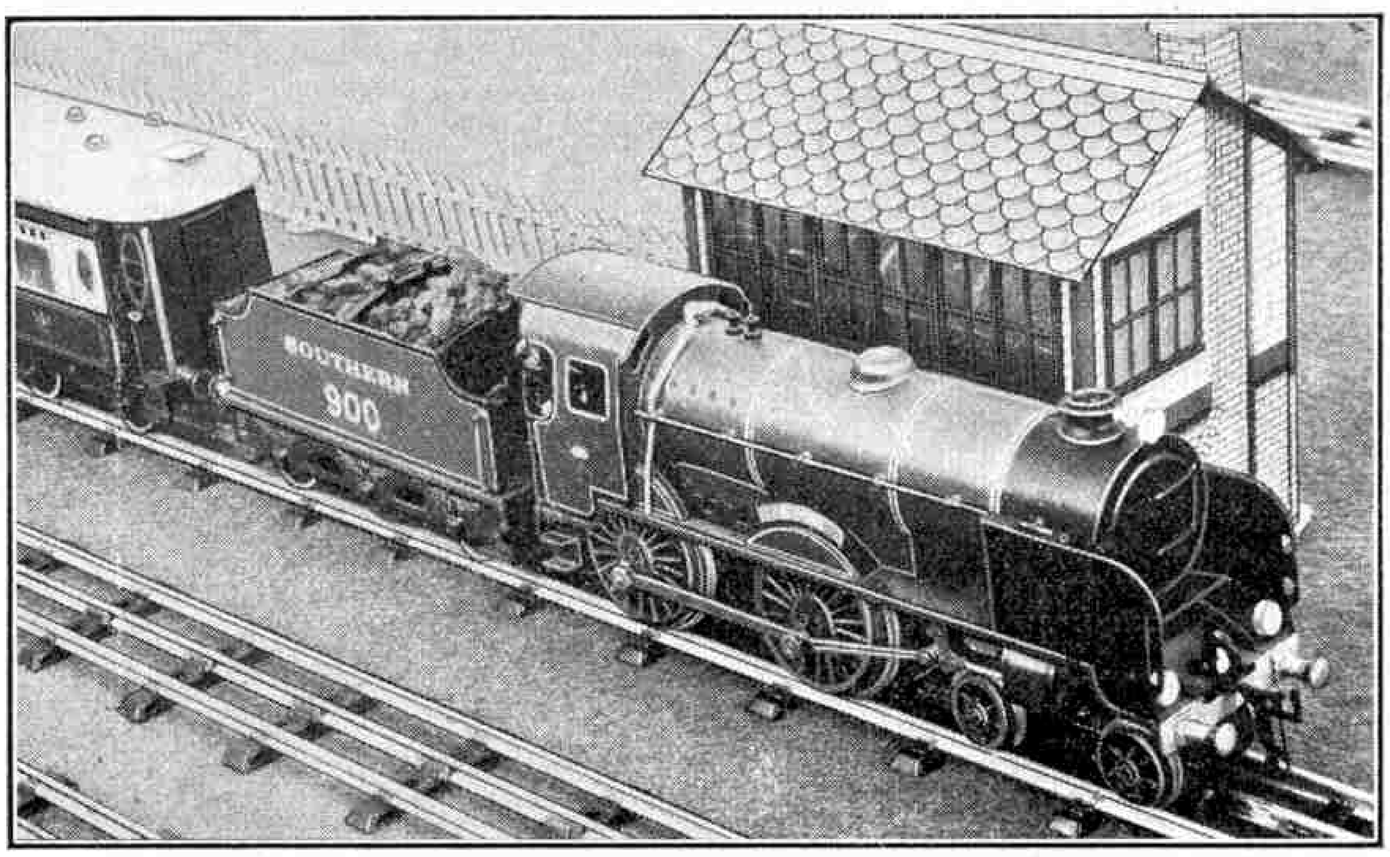
359. NORWOOD AND DISTRICT—Mr. B. W. Jordan, Flat 2, 99, Central Hill, Upper Norwood, London S.E.19.

Locomotive Running on Hornby Railways

The Thrills of Real Working in Miniature

THE fun of running a Hornby Railway comes chiefly from the actual working of traffic. Last month we explained how to handle trains at stations, and now we come to the subject of making the best use of engines.

The running of a Hornby Locomotive and the maintenance of the engine according to the instructions packed with it are simple enough, and the new owner is thrilled when he first attaches his locomotive to the passenger coaches or goods vehicles of his Set, and runs a complete train over the track he has laid down. The game becomes far more fascinating however when he begins to use his imagination and to pay attention to detail. He has the example of actual practice in locomotive working to guide him. This he can watch at the nearest station, or in some other suitable place, and the real and model railway articles that appear regularly in the "*M.M.*" are an even greater help, for they tell him exactly what he wants to know in order to have a really good time.



The Hornby E420 Locomotive "Eton" hauling a miniature "Royal Special." The engine displays the S.R. head signal for the work by means of the discs that are provided with this locomotive.

Every Hornby Railway owner can consider himself to be the Chief Mechanical Engineer of his line, for he obtains, or has obtained for him, the locomotives required by the traffic on his system. He is also his own Locomotive Running Superintendant, deciding on what duties the various locomotives shall be engaged, and making arrangements for running trains of all kinds on the system. He is, in fact, in the happy position of being in complete control, and can take care that his engines are not chosen in haphazard fashion, but selected to work traffic for which they are suitable. The range of Locomotives in the Hornby Series is a large one, and as a result the best can be chosen for almost any kind of service.

For the fastest and heaviest passenger trains the first choice on many Hornby railways, especially those which reproduce L.M.S. practice, will be the splendid 4–6–2 "*Princess Elizabeth.*" This is truly an engine to be proud of, and it will deal with almost any load that is likely to be found for it in the same efficient way as the real Stanier 4–6–2s on the L.M.S. A point in connection with its operation that concerns the Running Superintendent of a miniature railway is that for the best results it should be used on the large-radius curves afforded by the Hornby Solid Steel Track. It can be operated over the standard Hornby Tinplate 2 ft. Radius Curves, but if a layout incorporates a circuit of both kinds of track the "*Princess*" should be kept to the solid steel sections. Such a restriction will be quite in accordance with actual practice, for there are many sections on our railways where the largest and heaviest engines are not permitted to run.

The engines of the E320 and No. 3C types named after the well-known "*Royal Scot,*" "*Flying Scotsman,*" "*Caerphilly Castle*" and "*Lord Nelson*" are less restricted in their sphere of action. On many layouts these engines will have to perform the hardest duties, owing to the fact that a 4–6–2 is not available. This is particularly so on clockwork-operated railways, for "*Princess Elizabeth*" is only available fitted with an electric motor. The E420 and No. 4C models of the famous S.R. "Schools" class locomotive "*Eton*" can be classed with the E220 and No. 2 Specials for traffic purposes. All of them are of the 4–4–0 wheel arrangement, and each is an accurate true-to-type model of a real locomotive.

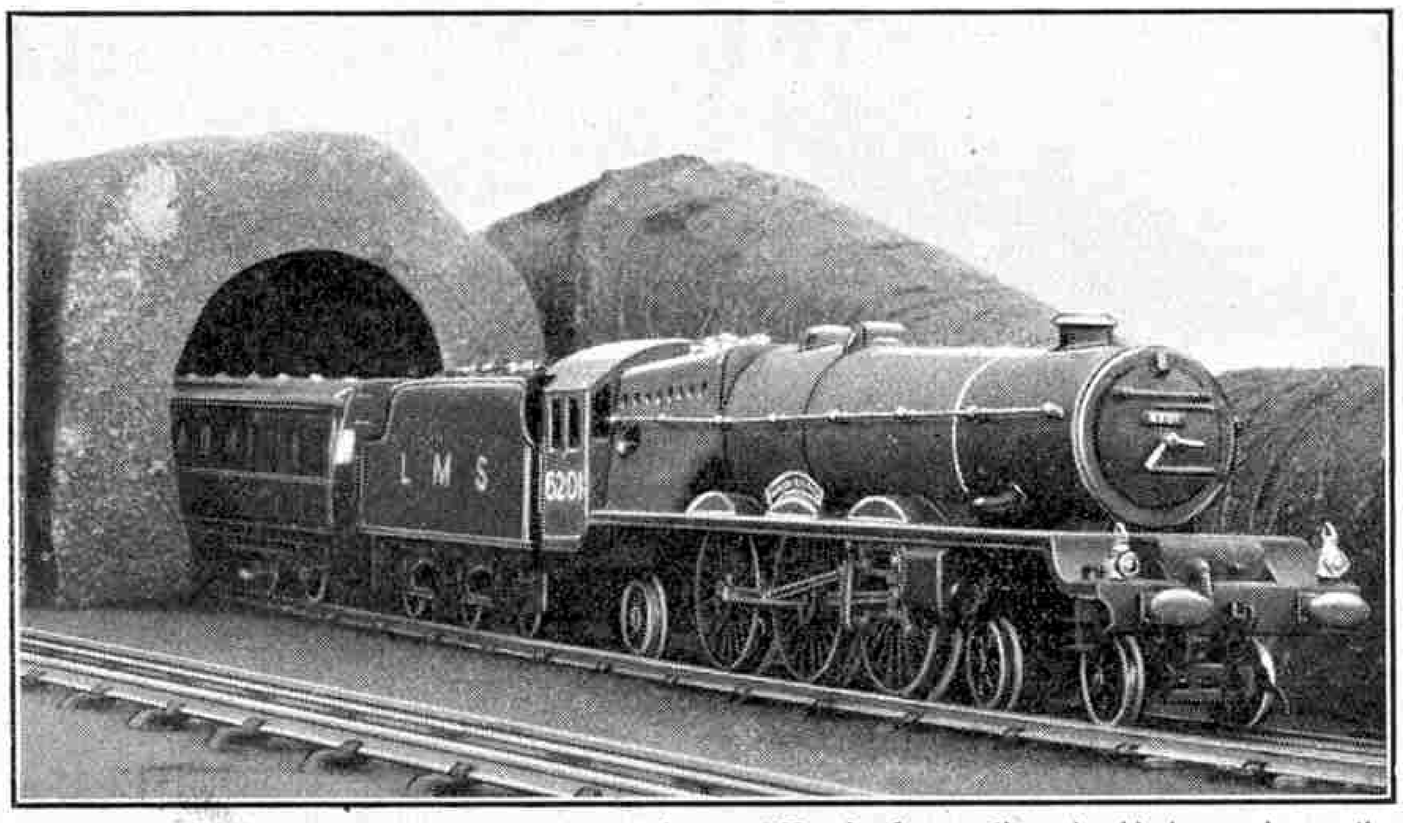
Following a common practice on real railways the No. 3 and No. 2 Locomotives can be used on fast freight trains of the more important kinds as well as passenger trains. Such mixed traffic working is frequently arranged in order to make the greatest possible use of the locomotive power available. The real "Schools" class incidentally are used only on passenger trains, although this rule may have to be relaxed in miniature.

Farther down the scale of Hornby Locomotives the very efficient modern mixed traffic engine has its miniature counterpart in the No. 1 Special type. Engines of this kind can be used equally well on passenger or goods trains as required. As they are four-wheeled locomotives only, they are of moderate size and do not take up a great deal of space in the always restricted sidings of a miniature railway system. The smaller Hornby Locomotives also can be considered as suitable for passenger and freight working, and where there are corresponding tank types these can be allowed to work on the same kind of trains as the similar engines with tenders, but on shorter journeys.

Coal and water represent the diet of the steam locomotive, and adequate supplies must be available at the various real locomotive depots. It is great fun as well as good railway practice to have proper coaling facilities in miniature. No engine indeed should leave the shed for its day's work without its complement of coal. It is easy to provide the tenders or bunkers of Hornby Locomotives with a realistic supply of fuel, for the Hornby Coal

introduced primarily for the purpose of loading wagons is suitable for this purpose, and it is easy to construct of Meccano parts a coaling plant that will form a most spectacular part of the equipment of the locomotive yard.

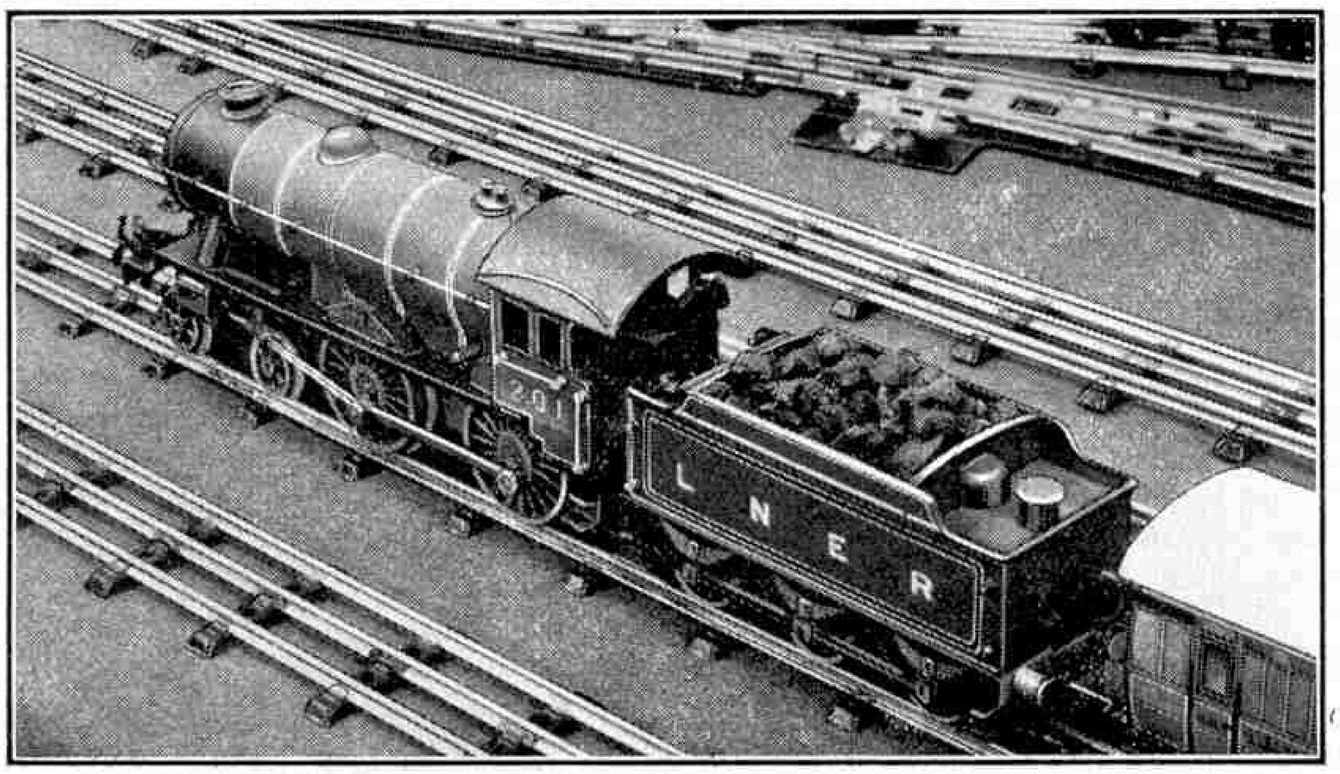
Hornby Coal can be carried loose in the tenders of locomotives, but not in the bunkers of Tank Locomotives unless a cardboard division plate is fitted to the back of the cab. A false tender or bunker top can be cut to fit tightly in the coal space and when in position is covered with Seccotine. Pieces of Hornby Coal are then stuck into position, and a very fine and realistic appearance is obtained if care is taken in "placing" the coal. This plan can well be followed with any engine, for the coal then cannot be upset and scattered as a result of a derailment or any other accident, and so the trouble of picking it up—and loose coal always falls in the most awkward places—is avoided.



Headlamps play an important part in traffic operations and Hornby Locomotives should always observe the head-lamp code. Here is "Princess Elizabeth" bearing the familiar "express train" indication.

Hornby Locomotives that are in regular use should be oiled at definite intervals. This is quite a good plan, and the oiling can be regarded as representing the regular examination given to real locomotives. The internal working parts of motors and mechanisms also should be given attention, and in particular bearings such as those of tenders fitted with axle-boxes, which are practically inaccessible when the locomotive is standing on the rails, can be cleaned and oiled.

If preferred Meccano Graphite Grease can be used for axle-boxes. This has the advantage of lasting a long time, and it cannot find its way on to the wheels and rails, as oil is apt to do. It does no harm to "go round" the engine with an Oil Can before a run, however, and it certainly gives a "real" touch to the proceedings, even if the "driver" is actually a giant compared to the engine! The slide-bars and piston rods can each be given a drop of oil, and the nuts on the crank pins should be tried to make sure that there is no tendency for them to work loose. If a coupling rod comes off its pin "on the road" it can cause quite a lot of trouble, even on a miniature system.



Coal in the tender adds to the realistic effect of a Hornby Locomotive. The tender of "The Bramham Moor" in this illustration is carrying a load of Hornby Coal, neatly trimmed.

With the engine fuelled and serviced there are still several items to engage the attention of the Locomotive Running Department of a miniature railway. The engine and tender should be cleaned if necessary. A dirty miniature engine looks particularly displeasing, for the odd smears of oil and inevitable finger marks have quite a different effect from the "weathered" appearance of a real engine that is in need of a clean-up. Usually a little rubbing with a soft dry cloth is all that is required for the housing or bodywork of a Hornby Locomotive, and the cloth can be worked into awkward corners with a matchstick. It is not advisable to apply any oil to the exterior of the locomotive, as this makes it impossible to avoid finger marks, and in any case the oily surface soon picks up dust.

If a specially good finish is required, say when an engine is needed for "Royal Train" duties, a wax furniture polish of good quality can be applied thinly and well rubbed with a clean soft rag. This gives pleasing results and the effects last a long time. This scheme reproduces in a sense the L.M.S. practice in locomotive cleaning, in which the engine is coated with a special wax preparation. Boilers, cab sides and tender or tank sides are the parts most suitable for such treatment, and any projections and corners that cannot be dealt with properly may be cleaned up in the manner already described. This may sound rather a laborious business, but actually involves little trouble. A clean and well-kept locomotive stud is an asset to any line, and engines that are carefully treated in this way will retain their splendid original finish for years.

A final matter before the locomotive commences a journey is to see that it carries the right number of headlamps, and that these are displayed on the correct lamp brackets. The British Standard Headlamp Code shows the class of the train according to the position of the headlamps on its engine, and details of this code will be found on page 12 of the H.R.C. Senior Booklet. Lamps that are "spare," or not required immediately, can be carried on the lamp brackets not in use for the moment. The lamps should be reversed to show that they are not to be regarded as part of the headlamp code, or they can be carried on the tender.

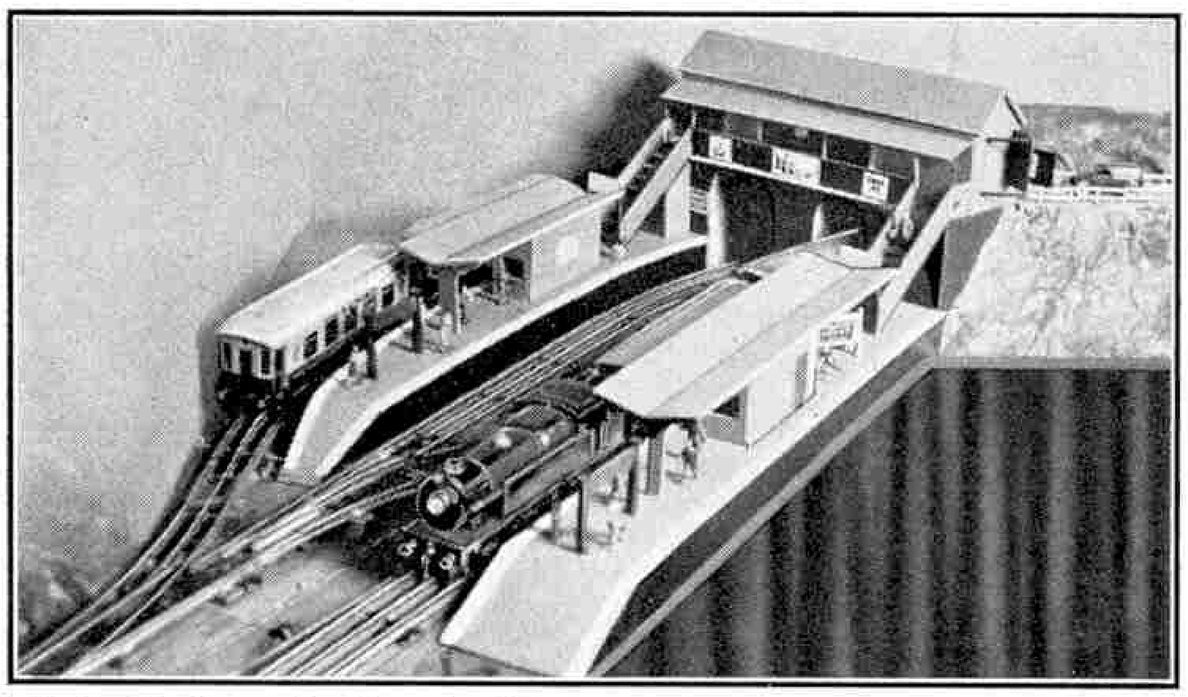
The Hornby *"Eton"* Locomotive is provided with miniature discs that reproduce the white discs displayed by S.R. locomotives during daylight, to indicate the routes of their trains. At night lamps are used; correct practice can therefore be followed in miniature.

The Mordon Gauge O Railway

An Imaginary Section of the G.W.R.

THE Mordon Model Railway, operated by Maurice Done, of Wednesbury, is laid down in a specially-made room situated between the bedroom ceiling and the actual house roof. The room is 15 ft. long and 9 ft. wide, and the track, consisting of Hornby Rails, is carried round it on a baseboard supported on trestles 2 ft. 6 in. high. Although the layout is not meant to represent any section of actual track it is based primarily on G.W.R. practice and is operated by Hornby G.W.R. Locomotives. Electricity supplies the motive power.

The railway serves three stations, "Mordon," "Waverley" and "Stretton" respectively. These structures are home-made but very realistic, as the illustrations show, and they are situated more or less at regular intervals on the continuous track, which is roughly oval in form. Certain variations in the routing of trains are possible owing to the arrangement of outer through lines avoiding "Waverley" and "Stretton." An interesting point is that one section of the avoiding lines enters a tunnel at one end of the room, passes through the wall, travels for about 10 ft. behind it, and then emerges via another tunnel mouth. Although there are two parallel tracks on the inner main system, these do not necessarily form the usual up and down tracks of a double line, but they can be used by trains travelling in either direction according to the requirements of the operating programme.



"Mordon" Station on the railway described on this page. The overhead roadway and entrance is an effective feature of this well-built station.

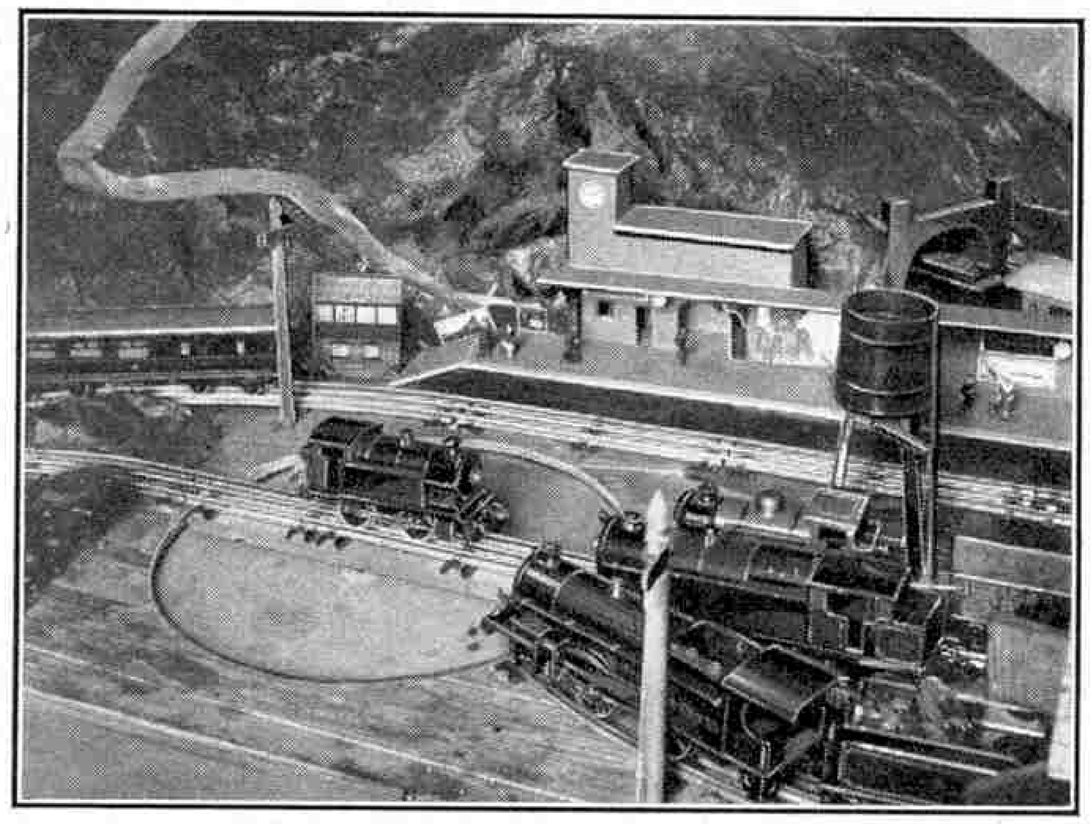
The best way for the reader to follow the details of the line is to trace the track of one of the frequent "Mordon"-"Waverley" expresses. The road serving the station at "Mordon" runs parallel with the track, which is here carried in a cutting. Thus the entrance and booking hall are at road level and span the main line, as shown in our upper illustration. So we arrive in imagination at the station and find that our train starts from Platform No. 2. When we get there we are just in time to see our locomotive, No. 4073 *"Caerphilly Castle,"* backing on to a train of luxurious Pullmans.

Two or three minutes later we get the *"right-away"* and move slowly round the curve out of the station. We pick up speed through the cutting, on one side of which lies the road, and emerge to see some beautiful mountain scenery, a gentle slope rising to the left, while on the right the land drops steeply away. An interesting point about all the scenic effects is that they, like the stations, were made at home, consisting for the most part of brown paper moulded to shape, covered with glue, sprinkled with sawdust, and then painted. Our view of the scenery is soon cut off, however, for we head on to the avoiding line and plunge into the inky blackness of a tunnel. This proves to be a long one, for it runs behind the wall previously referred to. When we emerge we can see down a valley in which cattle are munching the grass under the shade of some trees.

We soon enter another tunnel, a shorter one this time, and on emerging come into less mountainous surroundings. From here we see the line that serves "Stretton" and, further afield, the "Stretton" engine sheds. We get a glimpse of a well-equipped goods yard with a cattle pen on our right before we roar through a station and under a road overbridge. Actually this is "Mordon" again, but we must not notice the fact, a condition of a type imposed on "passengers" on any continuous model railway!

We pass through some fields and then, instead of turning off on the avoiding line as before, we keep to the main track and are soon slowing down for "Waverley," our destination. We rumble over a long viaduct, negotiate the points, and run into No. 1 Platform at "Waverley."

An interesting point is that both 20-volt and 6-volt trains may be run at the same time, if desired. This is because there are, electrically, two layouts. Each is controlled from a separate switchboard, one controlling the outer track and its sidings, and one controlling the inner track and its sidings. These two main sections are sub-divided into smaller sections, the current to each passing through a switch built up from Meccano Parts; thus any part of the line can be made dead if one locomotive is standing on it and it is desired to operate another train elsewhere. The switches on either switchboard can be made to operate 20-volt or 6-volt locos by the movement of a change-over switch. All the points and signals are controlled from the switchboard. Here also are the switches for lighting the stations and for controlling the turntable, which is turned by a Meccano E6 electric motor and is fitted with magnetic stops.



A view of the locomotive yard, turntable and station at "Stretton." The avoiding line passes through the hill in the background and a train can be seen entering the tunnel mouth on the extreme right.

Beyond this station the two main inner tracks part company. The one we have been travelling on makes connection with the outer avoiding line in the open space between the two tunnels. Its companion track takes a short cut across the corner of the room to serve "Stretton" and the two rejoin opposite "Mordon" Goods Platform. Had our train been bound for Stretton it would have had to use the crossover points when passing "Mordon" and then enter "Waverley" to join the "Stretton short-cut."

The layout is electrically-operated, and both goods and passenger trains are operated on the system. For passenger traffic, two bogie Pullmans, two No. 2 Corridor Coaches and four 4-wheeled carriages are available; for freight working 26 different wagons and vans are used. The two main goods yards are at "Mordon" and "Waverley," and there is also a siding at "Stretton" that deals mainly with coal for locomotive purposes, for the engine sheds are situated there. These sheds house the entire locomotive stud, which consists of a Hornby E320 *"Caerphilly Castle,"* and an E220 Special Tank, an E16 Tank and a clockwork No. 1 Tank. There is also a complete breakdown train stabled at "Stretton" that is kept ready for any emergency. Actually the services of this unit are seldom required, but it makes a very realistic addition to the equipment of the locomotive yard at "Stretton."

Join the Hornby Railway Company and become eligible for the competitions announced on this page.

H.R.C. COMPETITION PAGE

Join the Hornby Railway Company and become eligible for the competitions announced on this page.

MIXED NAMES CONTEST

Competitions in which jumbled names are to be deciphered have always attracted a large number of entries, and our correspondence shows that H.R.C. members continue to be just as keen as ever on this type of contest. We are commencing this year's contests, therefore, by giving members a further opportunity of showing their skill in solving this type of contest.

In the panel in the centre of this page are 16 locomotive names, the letters of which have been so jumbled up as to make them appear almost undecipherable. As can be seen, some of the names contain more than one word, and to make the contest even more interesting, the individual words also have been misplaced. In order to find the solution of the contest, therefore, the competitor is required to do two things:

(a) Decipher the jumbled letters, and form the words they make.
(b) Re-arrange the words thus formed to make up the complete locomotive names.

LILIWMA LACN	**GNIK KECZMAIEN**
NMLEIR RIS	**APHIOS**
SAMTOH RRNOSIAH	**NOSAN GEMDA**
ERGLA ENEIAL	**RSI HACLERS DEWDAR**
HOLC WIDLEIRF	**DWOGOILNOCL LALH**
DLRO WTELWAHI	**CRTEPSE**
SPNRICSE HORNANC 1	**WOPERSLAP**
BCMAPLEL KICFEERDR	**NBGRIHOT**

An example will help to make this clear. On arranging the letters of "LILIWMA LACN" in correct order the name "*William Clan*" is revealed. There is no locomotive of this name, but each of the two words will combine with words obtained in a similar manner from other jumbled names in the list to give true locomotive names. The locomotives represented must be further identified by the inclusion in the solution of the number, class, wheel arrangement and owning company of the engines represented.

When the puzzling collection of words and letters has been finally deciphered, a list should be drawn up in correct order, with the additional information required placed after each name. Every member should send in his list, even if it is not complete, for all will encounter equal difficulties, and an entry that is not correct in every detail may win one of the prizes offered. Each sheet sent in must have the H.R.C. membership number, name, and full postal address of the sender clearly indicated on the back. We would like to point out to competitors that the inclusion of all these details on *each* sheet submitted is most important, as an increasing number of entries are sent in each month, with one or other of the necessary items omitted resulting in the disqualification of what may well have been a winning entry.

The contest will be divided into the usual Home and Overseas Sections, and prizes of Hornby Trains, or any product manufactured by Meccano Ltd., to the respective values of 21/–, 15/– and 10/6, will be awarded to the three senders, in each section, of the most complete entries. A number of Consolation prizes will also be awarded. In the event of a tie for any prize, neatness and general presentation will be taken into consideration when the judges make the final decision.

Envelopes containing entries should be clearly marked in the top left-hand corner "*H.R.C. January Mixed Names Contest,*" and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, not later than 31st January. The closing date for the Overseas section is 31st March.

Drawing Contest

This month we announce another of our popular Drawing Contests, and in order to give each competitor a good opportunity to show what he can do, we are making no restrictions in regard to the subject, except that it must be connected with railways. On the back of each entry submitted must be clearly written the competitor's name, full postal address and H.R.C. membership number.

The competition will be divided into the usual Home and Overseas Sections, and in each there will be prizes consisting of any product manufactured by Meccano Ltd. to the values of 21/–, 15/– and 10/6 respectively. Several consolation prizes will also be awarded.

Entries should be marked "*H.R.C. January Drawing Contest*" and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 31st January. The closing date for the Overseas section is 31st March.

Voting Contest

This month we invite members to take part in a Voting Contest with the 12 main competitions of 1938 as candidates.

Each entrant is required to state which of the 12 main H.R.C. Contests of 1938 was his favourite, and also to give us his idea of the order in which the votes of competitors will place the eight most popular contests.

There will be two Sections in this contest, for Home and Overseas members, and prizes of any products manufactured by Meccano Ltd. to the value of 21/–, 15/– and 10/6 respectively will be awarded in each section to the three competitors who forecast most accurately the order of popularity of the contests that receive the most votes.

Envelopes containing entries should be clearly marked "*H.R.C. Voting Contest*" in the top left hand corner, and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 31st January. The Overseas closing date is 31st March.

H.R.C. Competition Results

HOME

October "Spot the Errors No. 3."—First: J. C. Button (10335), Crewe, Ches. Second: F. Gilbert (58935), Wokingham, Berks. Third: F. H. C. Hemsley (54891), Dunbar, E. Lothian. Consolation Prizes: R. Burrows (6144), Sudbury, Wembley; W. B. Hudson (1733), Weymouth, Dorset; L. J. Payne (48450), Luton, Beds.; E. Oldham (43390), Hyde, Cheshire; F. Mills (31), Kearsley, Nr. Bolton.

October "Layout Planning Contest."—First: W. B. Hudson (1733), Weymouth, Dorset. Second: D. A. Cook (56536), London E.18. Third: F. Mills (31), Kearsley, Nr. Bolton. Consolation Prizes: A. E. Draycott (36876), Arlesey, Beds.; J. Gale (19235), Lyndhurst, Hampshire; F. H. C. Hemsley (54891), Dunbar, East Lothian; J. H. C. Stenholm (60787), Kingswood, Surrey; C. E. Wrayford (6039), Bovey Tracey, Devon.

OVERSEAS

July "Photo Contest No. 4."—First: T. Watson (18065), West Leichhardt, N.S.W., Australia. R. Pearson (29199), Richmond, E.1, Victoria, Australia. Third: P. Macdonald (43305), Toronto, Canada. Consolation Prizes: R. Cremers (46896), Wijk Maastricht, Holland; F. L. Bingen (28995), Wijk Maastricht, Holland; L. Mulders (54757), Wijk Maastricht, Holland; G. C. Taylor (59265), Willoughby, N.S.W., Australia; E. C. Stonyer (10306), Marrickville, N.S.W., Australia; R. Myburgh (37538), Claremont, Cape Province, S. Africa.

SETS (Postage Extra)

10	Argentine	2d.	5	Cuba	2d.
15	,, ...	4d.	10	,, ...	4d.
20	,, ...	6d.	15	,, ...	6d.
25	,, ...	8d.	20	,, ...	9d.
30	,, ...	10d.	5	Dominican Rep. ...	3d.
5	Bolivia...	2d.	5	Ecuador	2d.
10	,, ...	5d.	10	,, ...	4d.
15	,, ...	8d.	15	,, ...	6d.
10	Chile	2d.	20	,, ...	9d.
15	,, ...	4d.	25	,, ...	1/-
20	,, ...	6d.	5	Guatemalor... ...	2d.
25	,, ...	8d.	10	,, ...	4d.
5	Colombia	2d.	15	,, ...	6d.
10	,, ...	5d.	20	,, ...	9d.
15	,, ...	8d.	5	Mexico	2d.
20	,, ...	1/-	10	,, ...	4d.
5	Costa Rica	2d.	15	,, ...	6d.
10	,, ,, ...	5d.	5	Paraguay	2d.
15	,, ,, ...	8d.	10	,, ...	5d.
20	,, ,, ...	1/-	15	,, ...	8d.

J. RUSSELL,
23. SHANKLIN DRIVE. WESTCLIFF-ON-SEA.

ONE THOUSAND STAMPS ON APPROVAL

From which you may select any 100 for 3/-.
This selection is not made up of the very commonest varieties, but contains stamps catalogued at 1/- each or more. (I do not sell less than 100.)
A returnable deposit of £1 is required from overseas applicants.
WANTED. A collection of POSTMARKS of Gt. Britain and Ireland. Write first stating number and price.
M. HARDY. "Hoyland." Potter Heigham. Norfolk.

JOIN our New Issue Bonus Approval Service—Western Imperial, Trowbridge, Wilts.

GREAT BRITAIN

Postally used 2/6 and 5/- King George V, cat. 2/7, sent free to all genuine applicants for approvals enclosing 2d. postage. Only one gift to each applicant.

Mention "Meccano Magazine."

R. D. HARRISON, Roydon, Ware.

100 DIFFERENT STAMPS FREE to applicants for ½d. approvals. Cox, 14, Broadmead Av., Worcester Park.

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(British 1840 Penny Black) for P.O. **3/6.** It is guaranteed genuine in every respect. Its companion stamp (1840, 2d. blue) for a further **5/9** (cat. 17/6)! Other "Classics" which every Collector should have are the **Cape of Good Hope Triangulars:** we offer 1d. rose (cat. 40/-) for **12/6;** 4d. blue (cat. 15/-) for **5/-;** and 6d. pale lilac (cat. 40/-) at **15/-.** Superb approvals of any country against approved English References or a deposit. **Full Lists Free.**

NORRIS & CO. (Dept. M), Norwood, London S.E.19.

NEW YEAR BARGAINS

45 CORONATION ISSUES (1 of each Colony) ... **4/9**
202 CORONATION (Complete issue — everything — Crown Cols. and Doms.), Mint **40/-.** Fine used **52/6**
15 JUBILEES all different—Mint and used **1/3**
5 NEW ZEALAND 'Chamber of Commerce,' scarce **2/3**
30 COMMEMORATIVES including Jubs., Cors., etc. **1/-**
BARGAIN APPROVALS OF BRITISH COLONIALS—including Jubilees, Mint and Used, Coronations in complete sets, New issues, etc.
FREE—SURPRISE GIFT to all customers during January.
T. R. Hughes (P.T.S.), **'Ibis Cottage,' Amersham, Bucks.**

FREE 110 DIFFERENT STAMPS FREE

To all genuine approval applicants who request my books of British Colonials, priced from ½d. each less 25% discount, I am presenting free of charge 110 different stamps, including the following pictorials: Four Australian 2d. Commemoratives, Jamaica, Canada, Kenya, Ceylon, etc., and many other stamps too numerous to mention (post free).

Eric J. Watts, 184, Northampton Road, Wellingborough.

130 DIFFERENT STAMPS FREE

This wonderful offer of long and short sets will greatly enhance the value and appearance of your collection. Fill up those empty spaces! It includes Coronations and mint Colonial stamps, Cyprus, portraits of Queens, Elizabeth and Mary, and finally a magnificent long set of **25 DIFFERENT CZECHO-SLOVAKIA.** Just send 2d. postage requesting approvals and free 1938 Catalogue.

LISBURN & TOWNSEND LTD. (Dept. M.M.), LIVERPOOL 3

Guaranteed "LUCKY" PACKETS

1,000 UNKNOWN UNUSUAL UNSORTED **1/6**

(Over 200 diff. Guaranteed)

Stamps on paper, etc. British Colonials and Foreign. Just as received from Convents, Missions, Banks, etc. Guaranteed unpicked. Chance of a valuable **FIND** in every lot. Send to-day for your treasure hunt to-morrow. 3 for 4/3; 6 for 8/-. Abroad extra postage. **FREE!** 25 diff. British Colonials, 5 Reign and Commemorative Packet to approval applicants. Also FREE duplicate exchange.

ENCLOSE POSTAGE. DEALERS SUPPLIED.

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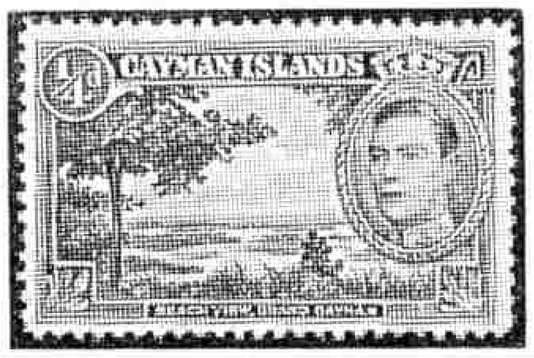

FREE Wonderful 1939 Offer 20 New Issues and Novelties

Including new **BELGIAN CONGO, CAYMAN ISLANDS** (King George VI), **CEYLON** (pictorial), **KENYA** (King George VI), **MONACO** (new design), Set of DENMARK, SPAIN, **STRAITS SETTLEMENTS** (King George VI), TURKEY, etc. I will send this collection **absolutely free** to all stamp collectors **sending 2d. postage (abroad 6d.)**

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A really marvellous packet containing 46 fine stamps, beautiful pictorials from **ORIENTAL COUNTRIES ONLY**—Temples, Mosques, Pyramids, Minarets, desert scenery, etc. **SPANISH MOROCCO, 2 IRAQ,** unused **OTTOMAN EMPIRE** (obsolete), Set of **10 TURKEY** including old and new issues, Sets of **5 EGYPT, 4 PALESTINE, BRITISH MOROCCO** (Geo. VI), **5 GEORGIA** (quaint-looking stamps usually sold for 5d.), Set of **5 ALGERIA** (pictorials), Set of **4 FRENCH MOROCCO** (large pictorials), Set of **6 TUNIS** (including bi-coloured Parcel Post). The last three sets alone would sell singly for 1/2—and 2 beautiful **SYRIA.** This is the finest packet for the money I have ever offered. Price 4½d. only. Postage 1½d. (abroad 3d. extra). Purchasers of the above asking to see my approval sheets will be presented with **10 PERSIA.** In addition to this senders of addresses of stamp-collecting friends will receive set of **6 POLAND.** **BARGAINS:** 20 Airpost, 6d., 100 B. Colonials, 1/-, 6 Triangulars, 7d., 20 Brazil, 6d.

H. C. WATKINS (M. Dept.), GRANVILLE ROAD, BARNET

FREE, BUT YOU'LL NEVER BELIEVE IT

12 K.G. VI ISSUES, INCLUDING SEVERAL SETS, other **FINE COLONIAL PICTORIALS** and **COMMEMORATIVES** including **SCARCE JUBILEE** and **CORONATIONS. SET OF 6 BOY KING PETER. SCARCE** issues from **ABYSSINIA. MONACO. BELGIAN CONGO. LUXEMBOURG. IRAQ. 5 MANCHUKUO,** etc., etc., in all

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3 TRIANGULARS FREE

To all applicants for our **WORLD-FAMOUS APPROVAL SHEETS** enclosing 2d. postage, we shall send these attractive stamps, also a packet of **STAMP MOUNTS** and **TRANSPARENT ENVELOPES** for duplicates. Do not forget to ask for our lists of bargains and sets.

Dept. 293, ERRINGTON & MARTIN,
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100 STAMPS FREE

This fine packet free to all applicants for approvals. Write to-day. **N. MITCHELL,**
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"DIAMONDS"

MANY RARE STAMPS have been found by purchasers of **The "DIAMOND" Packet,** which contains approx. **1,000 UNSORTED STAMPS** from convents abroad. **1 pkt. 1/6, 3 pkts. 3/9, 5 pkts. 6/-. All post free inland.** (Postage to Colonies 3d. per pkt. extra, S. Africa and Foreign 6d. per pkt. extra, Places on Empire Airmail Route 1/- per pkt. extra.) Beware of imitations.

O. NERUSH
(DEPT. "A"), 68, TURNPIKE LANE, LONDON N.8.

NEW YEAR BARGAINS

Large Brit. Col. and Foreign stock selling from 1/3rd to 1/8th Cat.! Great opportunity. **Send what you like** for Geo. VI new issue packet! Unparalleled bargains.
CAMPBELL, Haldon Avenue, TEIGNMOUTH.

For other stamp advertisements see pages 64 and xx

STAMP COLLECTING

BURMA issued a new series of stamps on 15th November to supersede the overprinted Indian stamps that have been used since the separation from the Indian Administration took place on 1st April 1937. This is the country's first definitive issue, and a most attractive one. There are 15 stamps in the series, with values ranging from 3 pies to 10 rupees, and these share the eight designs illustrated in our stamp pages this month.

The design for the 3 pies value, illustrated in the centre of the page, shows the King's portrait supported by two lions. It is used also for the 6p. and 9p. stamps, while a similar design bearing the King's portrait flanked by two dragons, is used on the 1a., 1½a., 2a. and 4a. values. The "supporters" in these two designs are representative of typical native wood-carving. Teak wood, in which most Burmese carvings are executed, does not lend itself to elaborate and intricate work, and for that reason the Burmese native craftsmen are not in the same class as the Chinese, the Maoris and other races noted for their wood carvings. The Burmese have practised wood carving from very early times, however, and there has been built up a tradition that shows itself in the characteristic forms given to the ogres, demons, dragons, peacocks, lions and tigers that are commonly portrayed in these carvings.

All sacred buildings and most royal houses bear examples of carvings, usually on the eaves and gables. The multiplicity of such work is due to the tradition that the building of a pagoda or temple is a holy work that ensures for the builder a place among the saints. Burma therefore abounds with pagodas. The restoration of an old building is not as good a qualification for sainthood as erecting a new one, and thus it is a common sight to see a new temple rising up alongside a number of older ones in varying stages of decay.

The flamboyant spires and horns are peculiar to the temples and pagodas of Burma, and are seen also on other structures where ornament is used. An excellent example of this characteristic design is shown on the 2a. 6p. stamp, which illustrates the Royal Barge. This is a floating pagoda in honour of the god Buddha, an image of whom, known as *Pangdaw-U* (Buddha of the Royal Boat prow), is carved on the prow of the barge.

A Water Festival is held

ON THE ROAD TO MANDALAY

on the Inle Lake, an offshoot of the great Irrawaddy River, during the closing days of September each year, and during this festival the *Pangdaw-U* is brought reverently across the lake from its resting place to the capital town of the Shan State, where it lies for two days while the people of the town pay homage to Buddha. A customary tribute is to overlay the image on the prow with gold leaf, and in the passage of time—the Royal Barge is reputed to be several hundreds of years old—so much gold leaf has been laid on the figure that its features have become almost obliterated.

The 8 annas value shows the native boat known as the proa, which is extensively used for trading up and down the extensive Burmese waterways, the chief of which is the Irrawaddy River, navigable for over 900 miles above Rangoon, where it empties into the Bay of Bengal. The high poop and awning-covered after deck are special characteristics of the proa, but most interesting of all is the topsail, an unusual feature among these old-fashioned native river craft.

The most interesting of the series, and indeed one of the most attractive stamp designs of recent years, is the 3 annas value, which shows elephants piling teak logs in a lumber forest, a scene that never fails to fascinate visitors to Burma. Teak is the second most important of Burma's exports, there being nearly 140,000 sq. miles of forest in production. Teak represents only slightly more than 10 per cent. of the timber of these forests, but the other trees, mahogany, tulipwood, mulberry and padouk, a variety of gum tree, for example, do not readily withstand rough handling in transportation from the forests, and consequently the winning of such timber is a comparatively costly operation.

The working of the forests is carried out under very careful control. First the trees to be felled are" girdled" by cutting right through the bark and soft sapwood to the hard wood beneath. The effect of this operation is to stop the flow of sap and to kill the tree. It is not felled immediately, however, but is left standing for three years to season the timber naturally, and during this time the bark and smaller branches fall away. After felling, the tree is cut into rough logs which are piled by elephants in readiness for the time when rain-swollen rivers will bear the logs down stream to the mills.

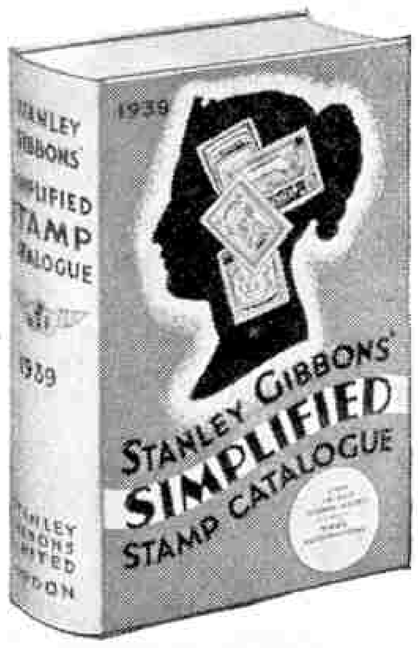
Each elephant carries a mahout or driver, but really the animal requires very little guidance. He approaches a huge log, perhaps six or seven feet in girth, feels gently around it with his trunk, testing the weight and balance here and there, and then when satisfied that he can manage the log by himself, he pushes and pulls at it until he is able to go down on his knees, and push his tusks underneath. Then he wraps a couple of turns of his trunk around the log, lifts it as though it were the

(Continued on page 65)

You'll be lost without a 1939 STAMP CATALOGUE

We read recently that "a collector without a catalogue is as ridiculous as a gardener without a spade." We would suggest that a collector without the latest Gibbons' Catalogue is like a gardener trying to dig with a bent spade with a broken handle. Do not handicap *your* collecting, get one of the Stanley Gibbons' 1939 catalogues *to-day*.

STANLEY GIBBONS' SIMPLIFIED CATALOGUE



The world's most wonderful and most popular five-shilling catalogue. Lists all the world's stamps (59,033) in simplest form, including the many fine King George VI new issues. No less than 7816 large stamp illustrations. Published late, and therefore the most up-to-date 1939 catalogue. **5/–**, *postage extra, U.K. 6d.*

"BIG GIBBONS" 1939

Best and most detailed catalogue, essential to every keen collector. Brand new feature—"Simplification Tables"—makes it easy for *all* collectors to use. 1924 pages, 22,105 price alterations, 2367 new issues added. ALL THE WORLD IN ONE VOLUME.

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NEW! KING GEORGE VI APPROVALS. The latest Stanley Gibbons' Approval Sheets are those containing the brilliant new King George VI stamps of the British Empire ONLY! Most of them are fine pictorials. Have you seen them yet? If not, wait no longer, but WRITE TO-DAY.

Remember there are S.G. Approval Sheets of all countries, with stamps both new and old, while every sheet contains many fine stamps priced as low as a penny each.

THREE BRILLIANT NEW GIFT PACKETS

CHRISTMAS 1938 PACKET. 120 DIFFERENT NEW ISSUES UNUSED OF THE PAST 12 MONTHS, inc. Newfoundland (Princess Elizabeth), Papua (pictorial air), Sudan (scarce air provisional), Bulgaria (chickens and boy Prince), Czechoslovakia (Armaments), Iceland (Geyser), Italy (Marconi), Jugoslavia (searchlights), Norway (reindeer), Panama (sports). **PACKET S 4894.** Price **12s. 6d.**

KING GEORGE VI PACKET. 82 DIFFERENT UNUSED KING GEORGE VI STAMPS. Remarkable and thoroughly representative packet as about 45 different parts of the Empire are represented and **every stamp has a different design,** many of them beautiful pictorials. **PACKET S 4895.** Price **10s.**

PACKET S 4896. AN EVEN BIGGER AND BETTER "NEW REIGN" PACKET. 146 DIFFERENT UNUSED STAMPS of the reign of King George VI, including all those in Packet S 4895 (see above) and additional higher values, making a splendid and very handsome display of the newest Empire stamps, which any collector will appreciate. **S 4896. 146 different stamps, unused, 20s.**

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STANLEY GIBBONS LTD.

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1938 Amazing offer! Gigantic packet of **NEW ISSUES ABSOLUTELY FREE.** Triangular, Air, Charity, King George VI, Commemorative, Pictorial and War issues including **HUNGARY** (St. Stephen), **GERMANY** (Air Raid Precautions), **COSTA RICA** (Exhibition), **VATICAN CITY** (Catacombs), **BULGARIA** (Harvesting), **FRANCE** (Pictorial), **RUANDA-URUNDI** (Native Porter), **GREECE** (Lady), **HONG KONG** (King George VI), **SPAIN** (War), **EIRE** (Father Matthew), **MONACO** (Deo Juvante), **GUINEA** (Village), **BOLIVIA** (Native School), **SPANISH MOROCCO** (Mosque), **JAPAN** (New Year), **NEW ZEALAND** (King George VI), **AFGHANISTAN** (Numerals), **RUMANIA** (King Carol), and **EGYPT** (King Farouk). All these yours **FREE** for the asking, just send us 2d. stamps (abroad 6d.) and ask for our Approvals.

WINDSOR STAMP CO. (DEPT. M), 59, LEE ROAD, BLACKHEATH, S.E.3.

UNUSED AFRICAN PACKET

Fine packet of unused African stamps from Belgian Congo (river scene), Morocco Agencies King Geo. VI, already obsolete, Italian East Africa (Abyssinia, etc.), Sudan, Somali Coast, Kenya, Cameroons, a fine set of 5 Ivory Coast, new issue, inscribed in error 'Baloue Woman' for 'Baoule Woman'—one is already obsolete—and another set, only just issued, of French Guinea, Mozambique, etc. etc., 30 stamps in all, sent free to all genuine applicants for approvals enclosing 2d. postage. Only one gift to each applicant.

R. D. HARRISON — ROYDON — WARE

FINE PICTORIAL STAMPS FREE

This wonderful packet containing LARGE PICTORIALS mostly bi-coloured—IVORY COAST, SENEGAL, WALLACE IS., 3 POLAND, ALGERIA 1937, AUSTRALIA (Commemorative), S. AFRICA, UKRAINE, CORONATION, TUNIS, Set of HUNGARY, CZECHO-SLOVAKIA, 2 EQUATORIAL AFRICA (New), etc. The above packet will be sent FREE to all who apply for my new lists of approval sheets and send 1½d. for postage. In addition, all who send me stamp collectors' addresses will receive 6 Persia or 6 Venezuela stamps FREE. 100 B. Colonial 1/-, 20 Airpost 6d., 6 Triangulars 7d., 1,000 different 3/11, 20 Brazil 6d., 20 Peru 6d. **H. C. WATKINS (M. DEPT.), GRANVILLE ROAD, BARNET.**

GREAT ANNUAL STAMP SALE

Sale Catalogue Free

Ask for a 40 Collection Sale Lot to be sent you on 7 days' approval. These are priced from 2/- per lot and catalogued up at 100/-. If you do not require the whole lot, single stamps may be purchased at the marked prices. **N. T. HILLIER, "Stamp Club," HORSMONDEN, KENT.**

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100 FINE STAMPS FREE!

In order to advertise our new series of approval books, we are offering a free gift packet of 100 all different stamps from all parts of the world, including many of the less common stamp issuing countries, such as ABYSSINIA, AFGHANISTAN, EPIRUS, GWALIOR, KOUANG-TCHEOU, TRAVANCORE, TRANSVAAL, etc., and also a rare old Russian Commemorative Stamp, catalogued at 2/6. To get this packet, just send 1½d. postage (abroad 6d.) and request approvals.

D. GREENHALGH, 384, Moss Lane East, Manchester 14.

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50 Diff. King George VI Colonials **5/-**
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100 Different Colonial and Foreign Pictorials including many new issues, **5/-**
USED COLONIAL CATALOGUED 3/-, FREE to every purchaser.

C. A. MASTERS, BROADSTONE, DORSET.

FREE STAMPS

100 ALL DIFFERENT, 2 INDIAN SILVER JUBILEES AND 1 MOZAMBIQUE TRIANGULAR AIR MAIL

to introduce my low-priced approval books containing stamps from ½d. Liberal discount given, and a list of 133 further bonus gifts of Coronations, Jubilees, Commemoratives. Please send 2d. for postage.

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"Worth While" GIVE YOU **25 - Different CEYLON - 25**

including **Queen Victoria, Edward VII, George V Jubilee, War Tax Coronation.** This representative collection of Ceylon stamps will be sent to all applicants who send postage and ask to see a selection of my "WORTH WHILE" approval sheets. Remember . . . . "WORTH WHILE" sheets for stamps worth while.

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506 STAMPS FREE!

This large gift parcel contains **506 UNSORTED FOREIGN STAMPS,** many scarce, from **MOZAMBIQUE** (Airmail), **JAPAN** (Magoya), **CHARKHARI** (Native Scene), **RUSSIA, GREECE** (Acropolis), Czecho-Slovakia, old British (1881), etc., etc. **FREE TO ALL** sending 2d. postage (abroad 1/- P.O.) and requesting my **FAMOUS EXTRA-LARGE-DISCOUNT** approval sheets. **E. EASTICK, 22, BANKSIDE ROAD, BOURNEMOUTH.**

DON'T BUY JUNK!

Let us send you our **OVERSEAS** packet containing 100 different selected stamps, **NO** Europeans and over half Colonials. Post free 2/-.

THE SIDCOT STAMP CO., HEATON, BOLTON. *The Heligoland Specialists.*

For other stamp advertisements see pages 62 and xx

Stamp Collecting—(*Continued from page 63*)

most easily-managed article imaginable, and carries it away to the piling point.

The elephant is not content just to dump the log, however. His piling is a model of neatness and precision and he will not leave the log until he has placed it absolutely to his liking. The stamp gives an excellent picture of the elephant at work.

Rice, the staple food of more than 60 per cent. of the world's population, is Burma's principal export commodity and an area of over 17 million acres (half the total area of England) is devoted to its cultivation. The design of the 3a. 6p. stamp shows a Burmese farmer cultivating his rice-fields with an ox-drawn cultivator. Oxen are used almost exclusively for agricultural work in Burma, as in most Eastern lands.

The designs for the high values, 1 rupee to 10 rupees, show the King's portrait as their principal feature. In the 1r. and 2r. values the portrait is super-imposed on a background composed of the extended fan of a peacock's tail. The 5 and 10 rupee values show the King's portrait flanked by two Nautch girls, native dancing girls.

Poster Stamp Collecting

Recently there have been attempts to popularise the collecting of poster stamps, those gay little "stickers" that commercial firms, exhibition authorities and charitable organisations use for propaganda purposes. It has been suggested that as a collecting hobby such "stickers" deserve to rank on the same footing as postage stamps. That claim is fantastic, for the important reason that postage stamps are government productions, officially issued, and quantities therefore are limited to reasonable public demands, whereas poster stamps can be issued by anyone at all in whatsoever quantities he desires. It is merely a matter of printing and distribution.

Whether our readers collect these "stickers" or not is solely a matter for themselves. Certainly there would be considerable interest in the prettiness of their designs, but readers must not mislead themselves into accepting such a hobby as equal with stamp collecting, for the two cannot be compared.

Stamp Gossip
and Notes on New Issues

Antigua's King George VI Series

The newly issued King George VI series from Antigua provides a range of most entrancing glimpses of what is undoubtedly one of the loveliest of Britain's smaller Colonies. There are 10 stamps sharing four designs as follows: ½d., illustrated on this page, and 2d., English Harbour; 1d., 1½d. and 2d., Nelson's Dockyard; 3d. and 2/6, saluting battery at Fort James; 6d., illustrated, 1/– and 5/–, St. John's Harbour.

English Harbour lies on the south side of the island and occupies the crater of an extinct volcano. The approach is through a narrow landlocked channel that formed an ideal defence for the naval dockyard that was maintained there in Nelson's days.

The dockyard was founded in 1726, but it has been known as Nelson's Dockyard ever since it was used by Nelson in 1805 to refit his ships during their epic chase of the French fleet under Admiral Villeneuve.

Fort James stands upon an eminence in the hills behind English Harbour and commands the surrounding country and coastline, but it is no longer fortified and nowadays serves chiefly as a qurantine station.

St. Johns, the island capital, lies on the north-west corner of the island. It is not only the principal sea port of Antigua, but also a calling point for air liners. That is the significance of the flying boat shown in the stamp design circling over the city as though preparing to alight in the harbour.

Christmas Charity Issues

This month we are able to reproduce a specimen of the Child Welfare charity issue that appeared in Holland on 1st December. As was indicated in the advance note that appeared in the December "*M.M.*," the design symbolises the nearness of children to nature. There are five stamps in the series, each using the design illustrated.

At the time of going to press only a few of the other annual Christmas charity issues had appeared, but we hope to illustrate a range of these stamps in our next issue.

* * *

The Post Office has announced that shortly it will re-introduce stamps of 7d. and 8d. values, discontinued for nearly 20 years. The last British stamps of these denominations were printed in 1918, and were then withdrawn owing to the very small demand for them. The growing use of parcel mail has resulted in a new demand, which at present can be satisfied only by the use of two or more smaller values.

New and most attractive designs have been selected for the new stamps.

A Stamp Cruise

One of the most interesting displays of stamps that we have ever seen outside a dealer's shop or a purely philatelic exhibition has recently been on show in the display windows of the Canadian Pacific Railway on Trafalgar Square in London. The display was conceived as a novel idea of illustrating the many interests and attractions of the places touched upon in the course of C.P.R. world cruises, and particularly that upon which the famous liner "*Empress of Britain*" will embark this month.

The display consisted of a panoramic map of the world with the cruise itinerary outlined in white to show all calling points. Neatly laid out in frames beneath the map were postage stamps issued by the various countries on the line of route, starting at Monaco, where English passengers pick up the liner, having previously travelled across France by train. The route passes down the Mediterranean and the Suez Canal, on to India, Ceylon, Malaya, Siam, and the Dutch East Indies. Then it proceeds across the Indian Ocean to Durban and Capetown in South Africa, north to St. Helena and across the South Atlantic to Rio de Janeiro. From there the ship sails north for New York, calling at the West Indian Islands, Trinidad and Cuba, before returning across the Atlantic to Southampton.

The stamp display made up a remarkably attractive piece of publicity and suggests a good idea for any young reader who is called upon to prepare a stamp talk for his school Philatelic Society. Most schools to-day take part in the Ship Adoption scheme. It would be easy for any boy to map out a stamp display showing the trading route of his own school's ship.

New North Borneo Series

The most interesting new stamps this month undoubtedly will be the new issue of the British North Borneo (Chartered) Company that appears on New Year's Day, and with which we propose to deal in detail in our next issue. The issue comprises a full set of 15 values, with a fascinating range of designs depicting all phases of life in North Borneo, including buffalo transport; proboscis monkey; 6c., mounted bajaus; orang-utan; Murut with blowpipe; Dyak; river scene; native boat.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

New Dinky Toys Aeroplanes

Important additions to the scale model aircraft in the Dinky Toys Series are announced in the advertisement on pages iv-v. The most timely is undoubtedly the beautiful miniature of *"Frobisher"* (Dinky Toys No. 62w), the first of five new Imperial Airways' air liners that will be classed under that name. Interesting details of the actual machine are given in an article on page 14. Models of *"Falcon"* and *"Fortuna,"* two of the other "Frobisher" class air liners, will be added shortly.

Another new Dinky Toys model of special interest is a splendid reproduction of the famous Mayo composite aircraft (Dinky Toys No. 63). This aircraft consists of a 4-engined seaplane mounted on the back of a 4-engined flying boat, and the model reproduces excellently the features of the two components.

Keeping pace with the rapid delivery of *"Ensign"* class air liners to Imperial Airways, Dinky Toys models of five more of these 4-engined monoplanes (Dinky Toys No. 62p) are now available. They are *"Elsinore"; "Explorer"; "Echo"; "Ettrick"* and *"Elysian."* The first Dinky Toys model of this new Imperial Airways' class of air liners is a reproduction of *"Ensign"* itself, as announced in last month's *"M.M."*

On the military side a very interesting new Dinky Toys aircraft is a model of the Armstrong Whitworth "Whitley" Bomber (Dinky Toys No. 62t). The model is finished in the non-reflecting brown and green scheme of camouflage, or "shadow shading," adopted by the Air Ministry. The "Whitley" is in extensive use by the R.A.F.

New Edition
Enlarged and Reset

Wireless for Beginners

by C. L. BOLTZ. 4'6 *net.*

New material on ultra-short waves and television receiving sets is included, together with new chapters on valve design and the progress of the super-het, which brings this well-known book right up-to-the-minute. Of Mr. C. L. Boltz, the *Wireless World* says: "A reliable and painstaking guide, possessing, moreover, a nice sense of humour."

OF ALL BOOKSELLERS.

Published by

HARRAP

SOLUTIONS OF DECEMBER PUZZLES

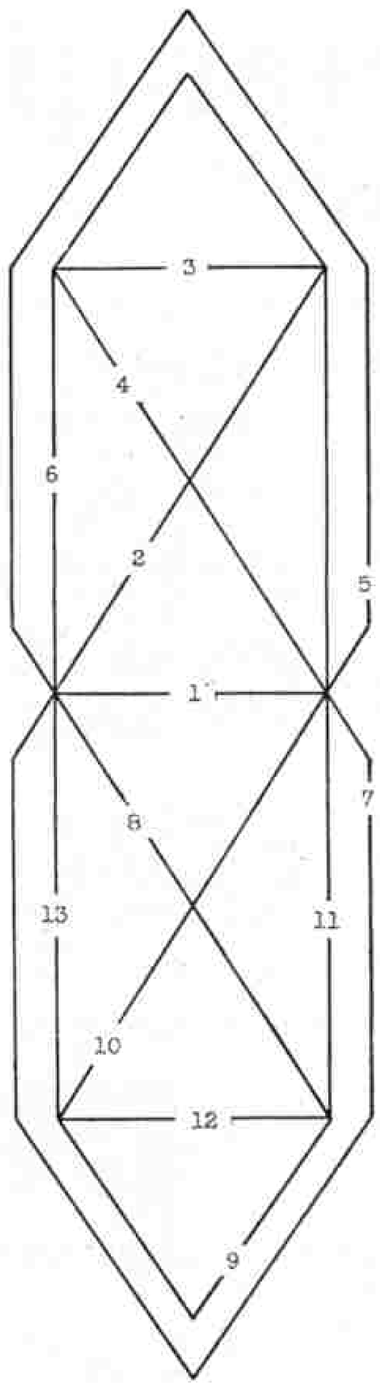


Fig. 1

Puzzle No. 1. In Fig. 1 the lines are numbered in the order in which they should be traced.

Puzzle No. 2. In the number that your friend gives you the right-hand figure denotes the number of the word, the next one the number of the line, and the figure or figures remaining the number of the page.

Puzzle No. 3. Although the girdle is only three yards too long it will be nearly a yard away from the Earth's surface.

Puzzle No. 4. The cuts must be made along the straight lines PR and QR, and Fig. 2 shows how these are drawn. The four pieces can then be placed together to form the square.

Puzzle No. 5. The pipes are laid as illustrated in Fig. 3.

Puzzle No. 6. Moving the four marked matches to the positions shown in Fig. 4 gives a total of 15 triangles.

Puzzle No. 7. It was unnecessary for the operator to ask what "C" was for. She only wished to know the letter.

Puzzle No. 8. The address is:
Raymond Harvie, Great Cross Hall, Robin Lane, Toppit-on-the-Hill, Dublin 1.

Puzzle No. 9. Here are the changes:
SOLO-SOLE-DOLE-DONE-DINE-DINT-DIET-DUET
TRIO-TRIM-TRAM-TEAM-BEAM-BEAD-BEND-BAND.

Puzzle No. 10. The builder required 9 figure "4s."

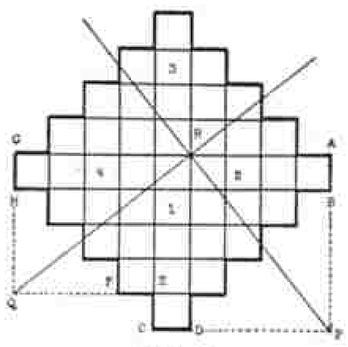


Fig. 2

Puzzle No. 11. There are of course two solutions to this puzzle, dependent on whether a black or a white counter is moved first. The movements correspond to each other, however, so we will give those commencing with the movement of the black counter lettered X, in square 5, Fig. 6. Here are the succeeding moves: Move counter X to square 4; C over to 5; B to 3; X to 2; Y to 4; Z to 6; C to 7; B to 5; A to 3; X to 1; Y to 2; Z to 4; B to 6; A to 5; Z to 3.

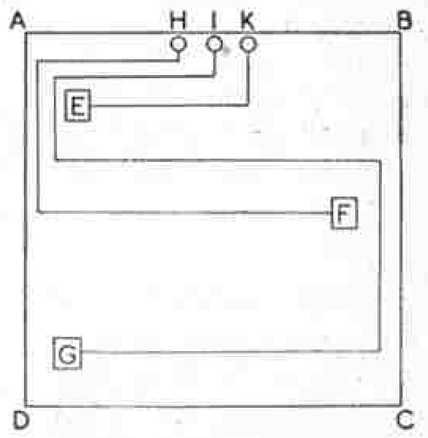


Fig. 3

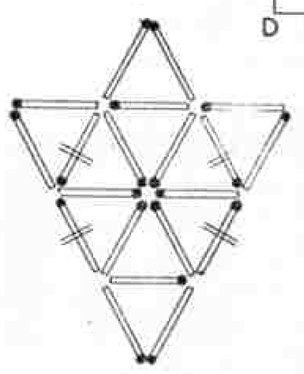


Fig. 4

Puzzle No. 12. The sentence reads: "A little darkie (dark E) in bed with nothing over him."

Puzzle No. 13. Here are the figures in the sum:

9647
587
10234

Puzzle No. 14. To find the number your friend crossed out, subtract the number he gives you from the next multiple of 9 to it. The remainder is the answer.

Puzzle No. 15. The final average of both bowlers is 3 runs per wicket. In order to see how this comes about suppose the more successful bowler has 27 runs struck off his bowling by the time he takes his first wicket. His average is then 3, the same as that of his rival, and taking the additional wickets leaves his own average unchanged, as each costs 3 runs.

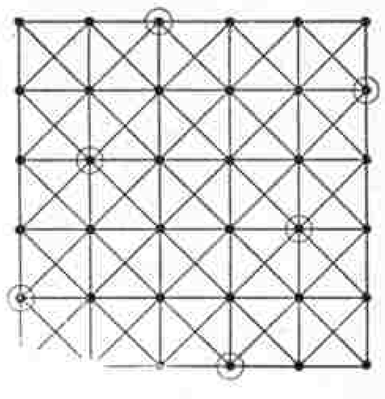


Fig. 5

Puzzle No. 16. The pins should be placed in the points marked by circles in Fig. 5.

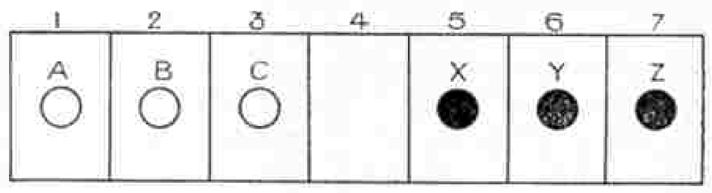


Fig. 6

Meccano in A.R.P. Work

By J. E. G. HENDRY

Readers of the *"M.M."* will be interested to learn that a machine built of Meccano assisted materially in the quick production of the first supplies of boxes for civilian gas respirators last October. I work in the office of a carton factory, where in order to get the necessary output quickly about half-a-ton of string made up in balls of about a hundred yards each had to be cut into the lengths of one yard required for each carton. We started by winding the string on to pieces of wood half-a-yard long, and cutting through after a number of turns had been wound. This was a slow process, however, as a girl could only wind and cut two balls in five minutes.

The problem was solved by making a Meccano winding frame. This consisted of two spiders, each made by placing two 12½ in. Strips in the form of a cross and securing them at their centres to Bush Wheels. The spiders were spaced by 7½ in. Strips to form a reel, which was then mounted on a Rod supported by a well-braced Meccano framework, and made to revolve by means of Sprocket Wheels and Sprocket Chain turned by a handle.

This device had the great advantage that the strings could be distributed along the frame as it was wound on, and the pieces therefore were more regular in length than those obtained by hand winding, which were bunched on top of each other. The time required for cutting two balls of string was reduced from five minutes to one minute. Later we were able to obtain strings already cut to length from the makers supplying them, but during the first rush the Meccano winder helped production considerably.

"Giant Moths of The Jungle"

We have received from our advertiser, Mr. Pentland Hick, Scarborough, an interesting booklet on foreign giant moths, explaining how to obtain and rear them in England. Full details are given of 14 of these moths, including the Giant Atlas from Asia, the Robin Moth, Moon Moths from North America and India, and others of equal interest and beauty. This is followed by notes on breeding and rearing. The booklet costs 1/- and it may be obtained from Mr. Pentland Hick, Athole House, Scarborough, who deals personally with any enquiries regarding the moths described in the booklet.

Hobbies A1 Fretwork Outfits

We are asked by Hobbies Ltd. to point out that the price of the Hobbies A1 Fretwork Outfit is 12/6, and not 72/6 as shown in the firm's advertisement on page xv in our December issue.

Competition Corner

WHICH WERE THE MOST POPULAR COVERS IN 1938?

The attractiveness of the coloured covers used for our 1938 issues has led many readers to ask for another cover voting competition on the same lines as those that have proved so popular in past years. We had intended in any event to present such a contest to our readers for we very much wish to know how far our readers' opinions agree with ours on the relative merits of these covers.

In the above illustration the covers that appeared on the various issues of the "*M.M.*" during 1938 are reproduced, those for January to June in the upper row, and those for July to December in the lower one. The reproductions are intended for reference purposes only. They convey nothing of the brilliancy of the colour of the originals, but new readers will find them of great assistance in forming their judgment. Those readers who possess copies of the 1938 issues, or are able to obtain them, should make a careful study of the originals before completing their entries.

Referring to each cover by its month of issue, each competitor is asked to state on a postcard:

A. Which of the covers he likes best of all.
B. His idea of the order of popularity of the covers as decided by the massed votes of all the competitors.

This list must cover the whole year, every month being included. The name of the month must be given, and its number in the volume. Competitors need not place their own favourite cover at the head of list B, unless they believe that it will prove to be the popular choice of the remaining competitors. They should place it in the position they think the massed votes will give.

The entrant's name and address must be added to the card, which should be addressed "*Cover Voting Competition*, Meccano Magazine, Binns Road, Liverpool 13." No competitor may submit more than one entry.

Prizes of Meccano products to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the four competitors whose lists most accurately forecast the final result. In the event of a tie for any of the prizes, preference will be given to the entry displaying the neatest or most novel presentation. The closing date in this section is 31st January.

A separate set of prizes, to be awarded in precisely similar conditions, will be awarded in the Overseas Section, which is reserved for readers living outside the British Isles and the Channel Islands. The Overseas closing date will be 29th April.

January Drawing Contest

Each month throughout the winter we are holding drawing competitions, open to readers of all ages. No special subjects will be set, the monthly prizes being offered simply for the best drawings or paintings submitted during the month. Entries may be of any size, mounted or unmounted.

Each month's entries will be divided into the usual two sections, A for readers aged 16 and over, and B for those under 16; and prizes of Meccano products or artist's materials, as chosen by the winners, to the value of 21/– and 10/6 will be awarded in each section. There will be separate sections with similar prizes for Overseas readers.

Entries in the January competition must be addressed "*January Drawing Contest*, Meccano Magazine, Binns Road, Liverpool 13," and must arrive not later than 31st January. Overseas closing date, 29th April.

Readers will be interested to see above the solution to the "September Crossword Puzzle." The names of the prizewinners in the Home section of this contest were announced in the November issue.

January Photo Contest

As was announced in our October issue, we have decided to continue our photographic contests throughout the winter.

The general conditions of the winter series of contests are similar to those of the summer competitions. Any outdoor photographs of autumn and winter interest will be eligible, but indoor subjects will be restricted to table-top photographs of the type described in recent "*M.M.*" articles.

Entries will be divided into the usual two sections, A for readers aged 16 and over; B for those under 16. Prizes of Meccano products or photographic materials to the value of 21/– and 10/6 will be awarded in each section. Entries to this month's contest should be addressed "*January Photo Contest*, Meccano Magazine, Binns Road, Liverpool 13." Closing dates: Home section, 31st January; Overseas section, 29th April.

EASIER

Tommy: "We're going to have a cricket match—West Indies against England."

George: "Then I suppose some of you will have to black your faces?"

Tommy: "Oh, no! Some of us are going to wash instead."

* * * *

A: "I was shipwrecked once and had to live for a week on a tin of sardines."

B: "You didn't have much room to move around, did you?"

* * * *

Doctor's Wife: "So you told that patient to diet?"

Doctor: "Yes, I ordered him to eat only the plainest food, and very little of it."

Wife: "Do you think that will help him to get well?"

Doctor: "It will also help him to save some money so he can pay the bill that he owes me."

* * * *

He had just returned from a visit to Germany.

"Did you have much trouble with your German?" a friend asked.

"None whatever," he replied, "but the Germans did."

* * * *

Jones: "What became of the man you employed last week?"

Farmer: "Oh, he's in hospital!"

Jones: "How's that?"

Farmer: "Well, he used to be a motor mechanic, and when my mule wouldn't go, he crawled underneath it to see what was the matter!"

* * * *

Teacher: "Anyone who answers the first question need not answer the second. Now: how many hairs has a horse?"

Tommy: "Please, sir, 5,318,402."

Teacher: "How do you know that, Tommy?"

Tommy: "Ah, sir, that's the second question."

* * * *

Visitor: "It must be terrible to be caged up here all the time. What were you before you came here?"

Convict: "A lift attendant."

* * * *

Boxer (boasting): "When I hits yer, you sure know something, and if I misses yer you catch pneumonia from the draught."

* * * *

Teacher: "If I stand on my head the blood rushes into it. Now tell me—when I stand on my feet, why doesn't the blood rush into them?"

Tommy: "Because your feet ain't empty, sir."

* * * *

For Sale: Fine bull-pup, 6 months old, well trained. Will eat anything, very fond of children.

* * * *

Errand Boy: "Is killing a pig murder, sir?"

Butcher: "No, murder, my lad, is assaulting with intent to kill. The other is killing with intent to salt!"

* * * *

A TALL ORDER

Broad-shouldered man to diminutive office-boy: "My name is Daniels. Tell your boss I've come to see him."

Office Boy: "So you're Mr. Daniels. That's awkward."

Daniels: "What do you mean—awkward?"

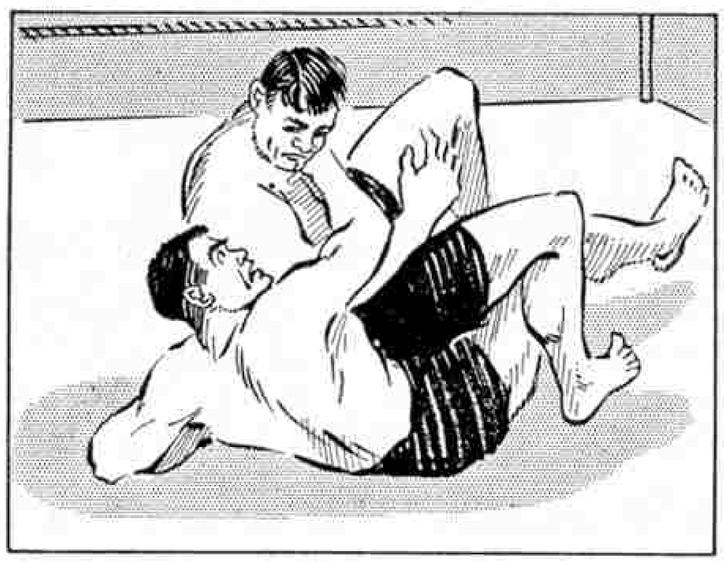
Office Boy: "I've been ordered to throw you out."

A SAD STORY

A dashing young fellow named Tim,
Drove his car with a great deal of vim.
He said: "I'm renowned
For covering ground,"
But alas, now the ground covers him.

* * * *

ALL IN!



1st Wrestler: "Wow! you're biting."

2nd Wrestler: "Well, do you expect me to swallow you whole?"

* * * *

Auntie asked Jill what has most impressed her on her visit to the zoo.

Five-year-old Jill thought for a moment or two, and then said: "I think the elephant, auntie. I loved to see him picking up buns with his vacuum cleaner."

* * * *

Mistress (to new milkman): "How much is my milk bill?"

Milkman: "S'cuse me, lady, but me name's Joe."

* * * *

Teacher: "Now, Tommy, can you tell me why they call cinema attendants 'Ushers'?"

Tommy: "Because they have to tell people to keep quiet!"

* * * *

"There goes a fellow who takes the worst view of everything."

"Is he a pessimist, then?"

"No, he's an amateur photographer."

* * * *

School Teacher: "Johnny, can you tell me the difference between perseverance and obstinacy?"

Johnny: "One is a strong will, and the other is a strong won't."

* * * *

Jack: "It isn't safe to hit Tommy Brown—his father's got a title."

Dick: "Titles mean nothing to me."

Jack: "No? This one's a boxing title!"

* * * *

The science lesson was in progress.

"What is the greatest change that takes place when water becomes ice?" asked the master.

"The price, sir," replied a bright scholar.

* * * *

Actor: "I must insist upon having real food in the banquet scene."

Manager (fed-up): "Just as you like, but then you will have to have real poison in the death scene."

* * * *

Stranger: "Say, bo, does Si Jones live round hyer?"

Quick-Draw Steve: "Nope."

Stranger: "But he told me he only lived a gunshot from you."

Quick-Draw Steve: "He did."

* * * *

Judge: "You say the stone he threw at you was as big as my head!"

Prisoner: "Yes, sir, but not as thick."

* * * *

THIS MONTH'S HOWLER

"You go to India by the piano boat."

SAVING TIME

Jones Senior (in the garden): "Hi! what are you doing to those onions, son?"

Jones Junior: "Just an idea of mine. Water 'em with vinegar and they'll grow up already pickled."

* * * *

Teacher: "And you, Willie, can you tell me the nationality of Napoleon?"

Willie: "Course I can."

Teacher: "That's right."

* * * *

Father: "Now, Bobby, play with those other children and don't get into mischief while I have a bathe, and when I come out I'll give you twopence."

Bobby: "An' if you don't come out, will mummie pay me the twopence?"

* * * *

Joe: "Why should a bank cashier make a good musician?"

Tim: "Because he makes a study of notes behind the bars."

* * * *

Injured one (to workman who had dropped hod of bricks): "Confound you! One of those bricks hit me on the head!"

Workman: "Lumme! You ought to consider yourself jolly lucky. Look at all them that didn't!"

* * * *

A general knowledge test was in progress.

"Now, Jack," asked the teacher, "can you give me an example of wasted energy?"

"Yes, miss," came the answer quickly. "Telling a hair-raising story to a bald-headed man."

* * * *

Passer by to Fisherman: "How are they biting?"

Fisherman: "Not at all. As a matter of fact there isn't a single fish in this whole stream."

Passer by: "Then why are you fishing here?"

Fisherman: "Because it pays me. Look at the money I save on bait!"

* * * *

Tommy: "Father has sent me for a piece of rope, please."

Shopman: "How much does he want?"

Tommy: "Oh, just enough to reach from our goat to the fence."

* * * *

Teacher: "Can any boy tell me what the Great Plague was?"

Jackie: "Lessons."

* * * *

Teacher: "If I said: 'I'm handsome,' what tense would it be?"

Pupil: "Pretence."

* * * *

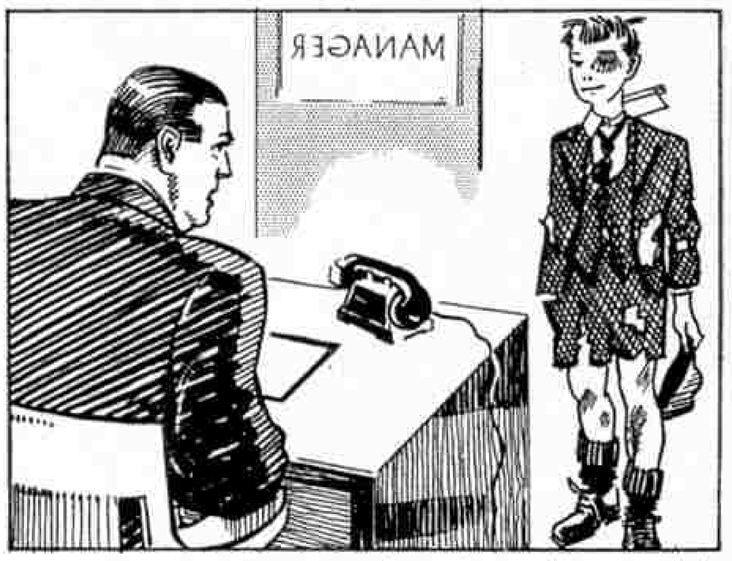
Wong: "You savvy that piano stool you sell me?"

Shopkeeper: "Yes, what about it?"

Wong: "No good! Me twisty, me twirly, again me twisty, but he makes no music."

* * * *

MADE SURE OF IT



Employer: "Well, you can have the position, my lad, but you would not have got it if I had any choice. Fancy coming after a situation with a dirty collar, a torn coat and a black eye."

Boy: "That's nothing; you should have seen the other three chaps that were after the job."

New Year Gifts

for some lucky boys. LUCAS'S store is literally packed to the ceiling with toys and games of every description. There are Conjuring Sets, Make-up Sets, Carpentry Sets, Flood-lighting Sets, Constructional Sets, Garages, Gliders, Minic, Dinky, Tootsietoys, Hornby Trains, and a complete range of Meccano. Tell Dad all about these good things NOW. If you want to obtain the fullest enjoyment in selecting "just the gift you have in mind," remember the name, LUCAS'S, the rest is easy.

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"The Boy's Arcadia"

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WORLD-FAMOUS AERONAUTICAL MODELS

FIRST and BEST SOLID NON-FLYING

1/72nd scale model Aircraft Construction with every accessory to make the complete Hobby.

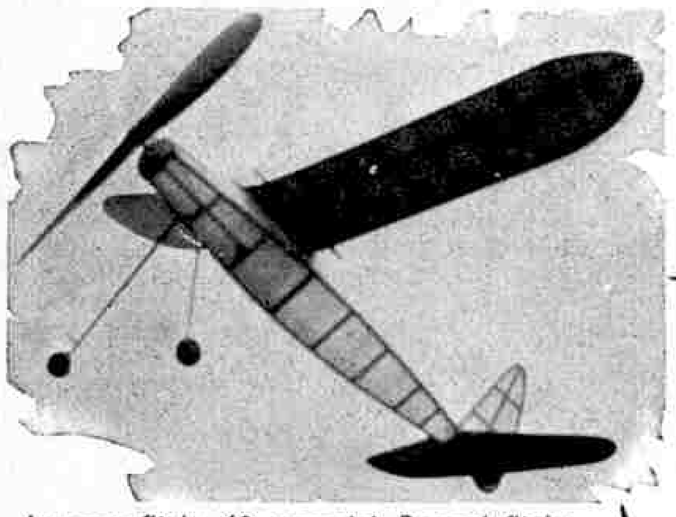
THE WORLD'S 3 FASTEST FIGHTERS

"HURRICANE," "SPITFIRE" and "CURTISS"

Constructive Sets, price **2/6** each

Photograph of Bristol "Blenheim" built from Skybird Kit.

Price **6/6**



Average flight 60 seconds! Record flight to date 120 seconds!

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"STURDY" MODEL *Span 30". Length 21½". Power—14" Rubber. Weight 2 ozs.* *Price complete* **6/6**

★ THE NEW No. 1 FLYING MODEL

Amazing Climb and Height!

A Strong Model with a contest performance!

Simple construction! A model which the beginner has been waiting for and the expert will want to fly.

LATEST ADDITIONS!

The BLACKBURN "SKUA"

Constructive Set **4/6**

The GLOSTER "GLADIATOR"

Constructive Set **3/-**

If you are interested write for Skybirds' free list:

"SKYBIRDS" (Desk B)

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Hours of splendid home enjoyment for all the family - with a Riley HOME BILLIARD Table

You can turn leisure hours into pleasure hours for all your family and friends. 8/- DOWN brings immediate delivery of a real Riley Billiard Table, not a toy, but a perfect replica of a full size Billiard Table. 7 Days' Free Trial given and all carriage costs paid. You pay balance monthly.

Riley "Cabriole" Model "Combine" Table, 6 ft. size £34/10/- cash or easy payments.

Rileys are the largest makers of full-sized billiard tables in Great Britain. Also specialists in second-hand tables, accessories, repairs, etc.

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4′ 4″ × 2′ 4″	£7 0 0
5′ 4″ × 2′ 10″	£9 0 0
6′ 4″ × 3′ 4″	£11 15 0
7′ 4″ × 3′ 10″	£15 0 0
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or in 20 monthly payments of 8/-, 10/3, 13/3, 17/-, 24/6

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Perfect furniture for the modern home. Convert to either use in a few moments. Many attractive models, oak or mahogany, in sizes for all rooms. Prices of round leg mahogany tables are:

5′ 4″ × 2′ 10″	£22 10 0	7′ 4″ × 3′ 10″	£33 0 0
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or in 13 or 20 monthly payments.

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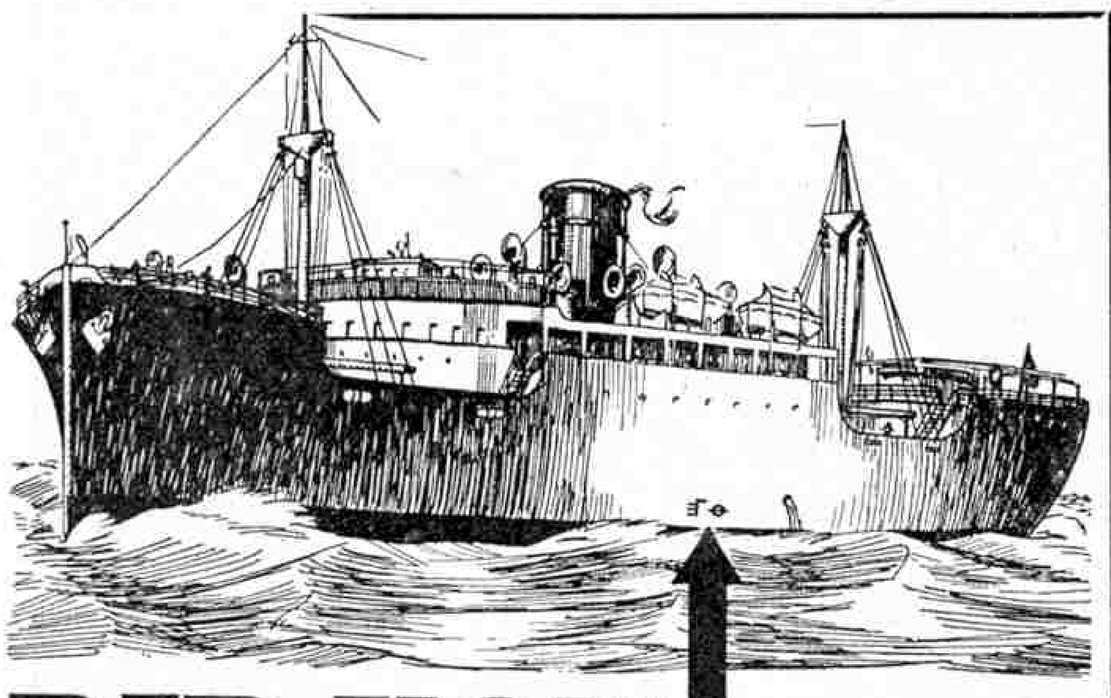
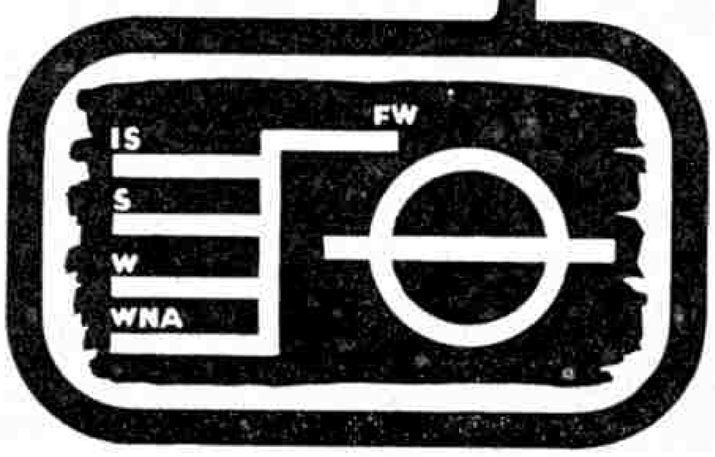


DID YOU KNOW?

THE PLIMSOLL LINE



Haven't you often wondered what these markings meant on the side of a ship in port? The Load Line, or Plimsoll Line, running through the side must **not** be submerged when the ship is fully loaded—although the markings on the left **do** permit the load line to be submerged in fresh water or during certain Seasons without any risk!

OF COURSE YOU KNOW....

you, too, should keep on the "right side of the line" and always use SECCOTINE whenever there's a sticking job to be done. Don't **you** take risks with **your** models by using inferior adhesives—SECCOTINE will never let you down.

Remember, also, SECCOTINE will stick practically anything—Wood, China, Metal, Glass, Cardboard, etc.—far stronger than any glue!

SECCOTINE has been famous all over the world for more than half a century. Still the formula remains unchanged! Still SECCOTINE has no equal!

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THE NEW SIMPLEX TYPEWRITER

Is a satisfying Toy because it does really produce perfectly type-written letters, cards, programmes, etc., with utmost ease.

It is guaranteed for two years' good work, and is undoubtedly the best Machine of its kind ever made. Over 1,000,000 are in use all over the world. It is a gift that any boy would be proud to possess. The Key Board is Standard as on Commercial Machines, and has training value for the future.

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From all Toy Dealers, Stores, etc.

Write for illustrated list M to:

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The booklet is obtainable (Price 3d.) from any Meccano dealer, or (Price 4d.) post free, direct from

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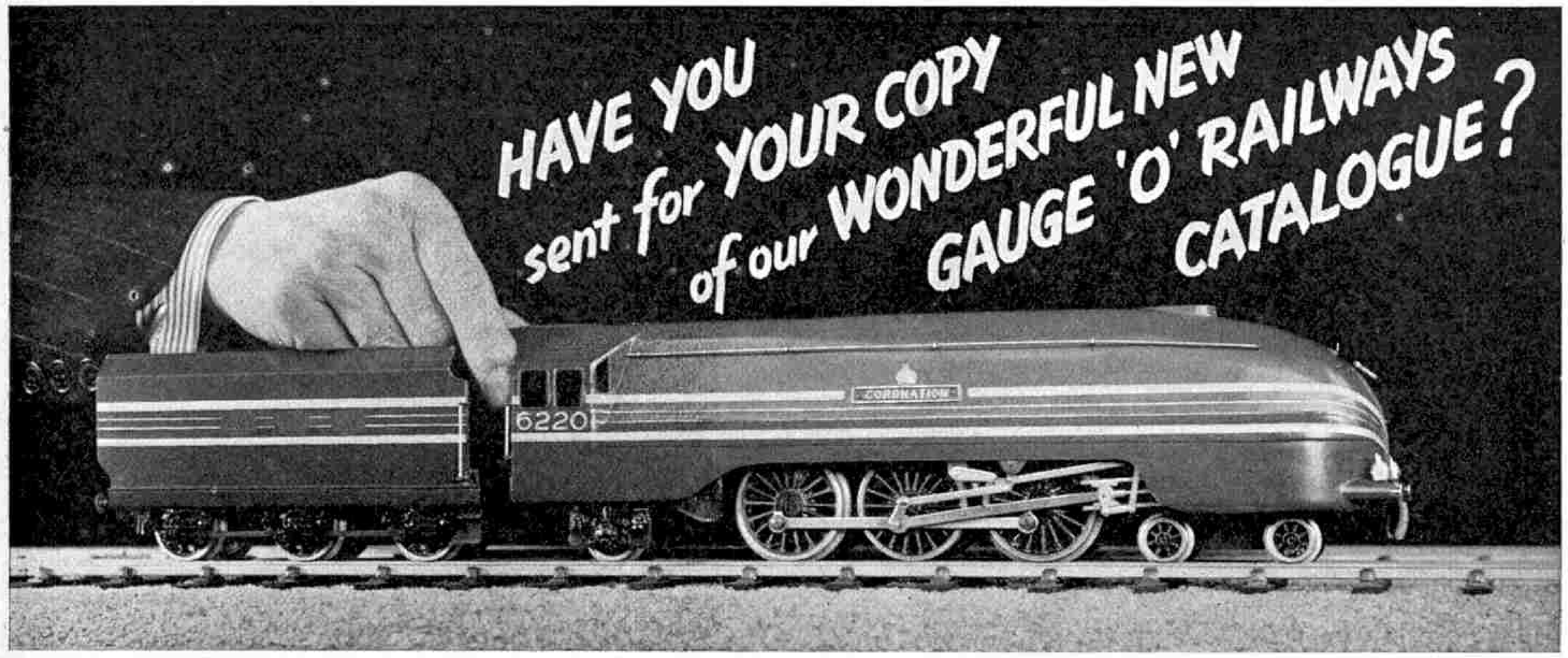
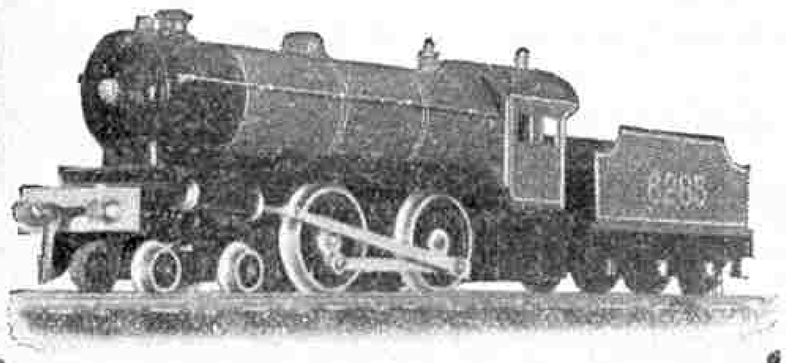


For some time we have felt there has been a real want for a concise and attractive book, presented in a new way, for the boy or man who owns, or is going to own, a gauge "O" railway!

After all, when comparing gauges, we must take into consideration the fact that in no other gauge have we such a wonderful variety of locomotives to choose from—streamline expresses, smart passenger locomotives with coaches, diners and mail vans, goods engines with their vast load of freight wagons.

Also we can control with equal ease by electricity, clockwork or steam in this most widely used of gauges, and in signalling and station accessories, gauge "O" is far ahead of smaller sizes.

BASSETT-LOWKE'S new catalogue GR.17 on Gauge "O" Scale Model Railways is the book for you, so send 3d. to Northampton now and make sure of your copy.



4–4–0 type ENTERPRISE No. 6285. Price **50/–**
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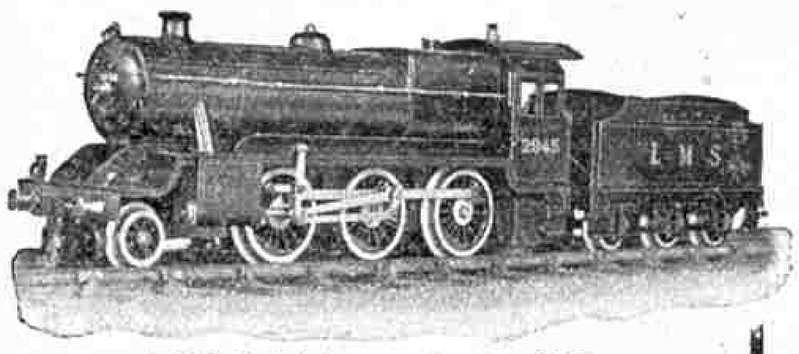

L.M.S. 2–6–0 Locomotive No. 2945
The Bassett-Lowke Moguls have always been popular, so recently they have produced L.M.S. and L.N.E.R. modernized models, incorporating most of the latest features. In steam or clockwork. Price **£5 5 0** each

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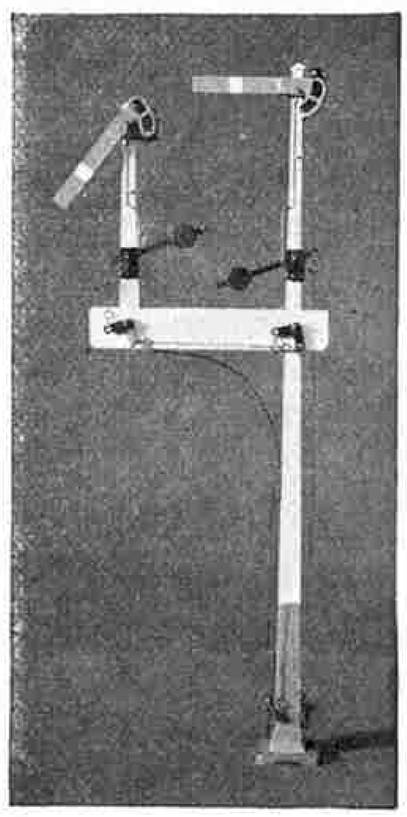

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Here we show one of our best quality scale model signals—a double arm home type, priced at **7/–**. We have a full series in this quality in both lower and upper quadrant.

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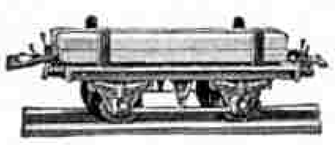

No. 1 TIMBER WAGON
Beautifully enamelled in yellow and red.
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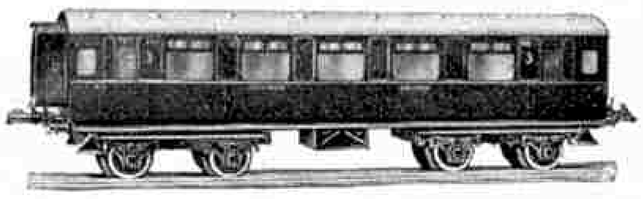

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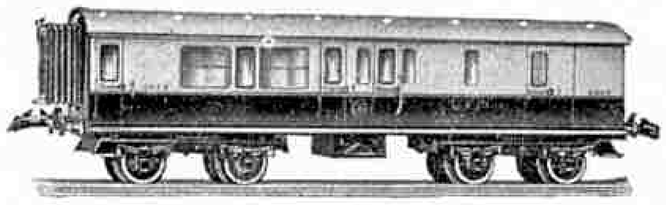
S.R. Third class. Not suitable for 1 ft. radius rails. Price **7/6**



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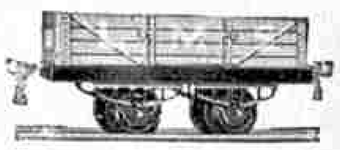
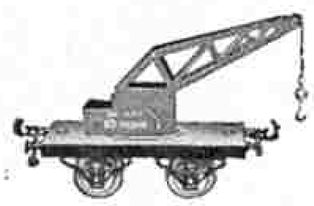
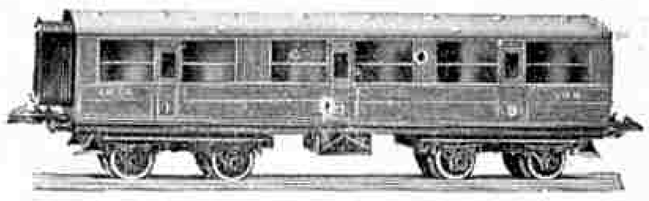
G.W. Brake composite. Not suitable for 1 ft. radius rails. Price **7/6**



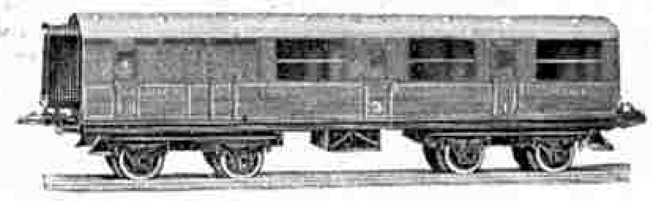
***M1 WAGON**
Price **10d.**



No. 1 CRANE TRUCK
Finished in brown and blue.
Price **2/9**



No. 2 CORRIDOR COACH
L.N.E.R. First-third. Not suitable for 1 ft. radius rails. Price **7/6**



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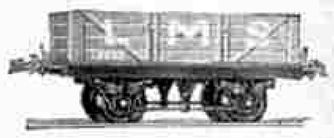
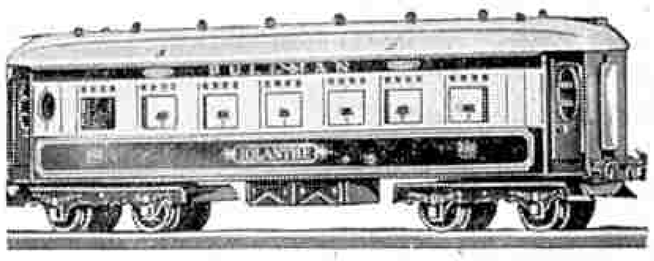
L.N.E.R. Brake composite. Not suitable for 1 ft. radius rails. Price **7/6**

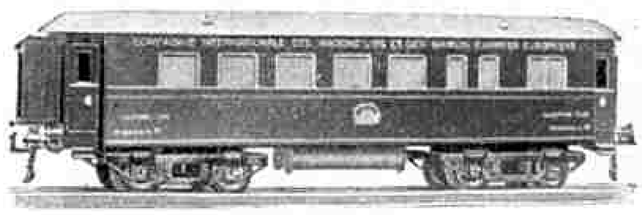


***No. 0 WAGON**
Price **1/3**

***FLAT TRUCK**
with Cable Drum.
Price **1/9**

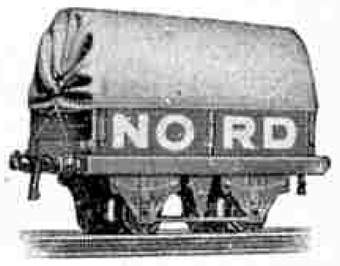


No. 2 SPECIAL PULLMAN COACH
Not suitable for 1 ft. radius rails. Price **13/6**

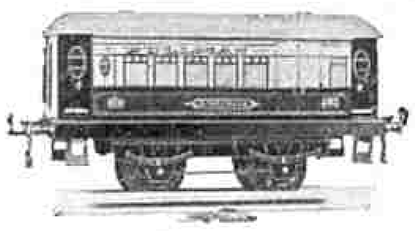


RIVIERA "BLUE" TRAIN COACH
"Dining Car" or "Sleeping Car."
Not suitable for 1 ft. radius rails. Price **11/-**

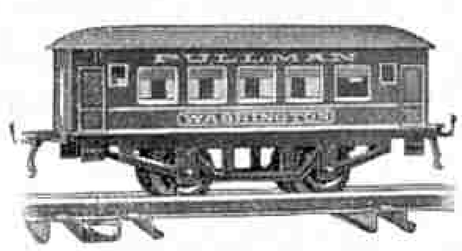
No. 3 "MITROPA" COACH
Similar in design to above. Lettered "Mitropa."
Price **11/-**



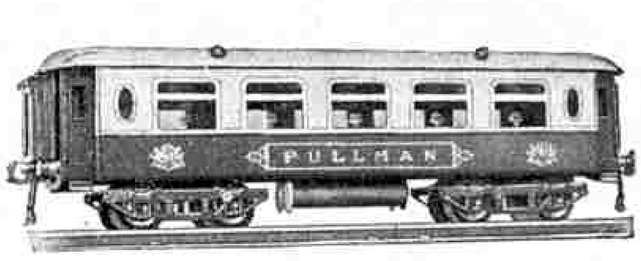
COVERED WAGON
(French Type)
Fitted with frame and sheet. Lettered "NORD." Price **2/6**



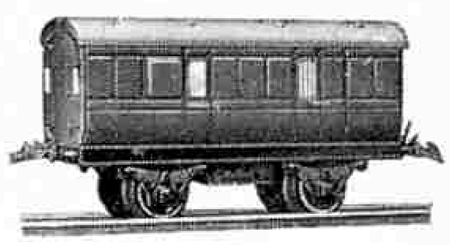
No. 1 PULLMAN COMPOSITE COACH
Price **2/6**



PULLMAN CAR
American Type (as illustrated).
Lettered "Washington" or "Madison."
Price **1/9**
Continental Type. "Mitropa" No. 0
Lettered "Mitropa." Price **1/9**

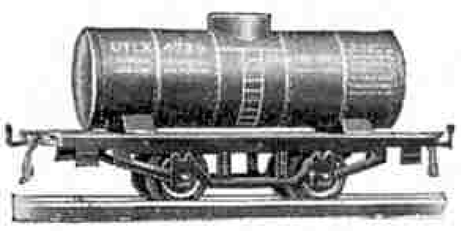


No. 2 PULLMAN COACH
Not suitable for 1 ft. radius rails. Price **10/6**

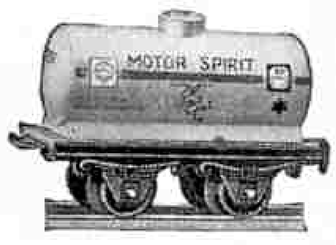


***GUARD'S VAN**
Price **2/6**

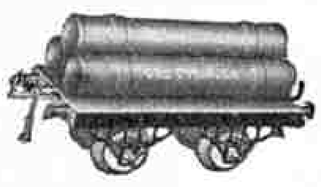
No. 1 PETROL TANK WAGON "POWER ETHYL"
Price **1/11**



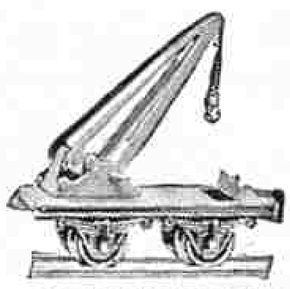
TANK CAR (American Type)
As used in America for the conveyance of oil, etc. Price **1/11**



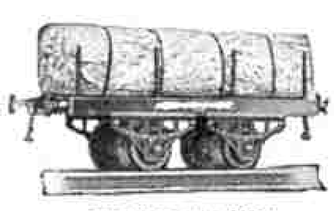
MO PETROL TANK WAGON "SHELL-B.P."
(MO Coupling). Price **1/-**



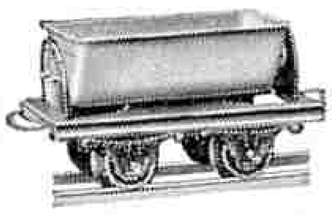
GAS CYLINDER WAGON
Price **1/8**



MO CRANE TRUCK
(MO Coupling). Price **1/-**



FIBRE WAGON
As used in France and other Continental countries.
Price **1/3**



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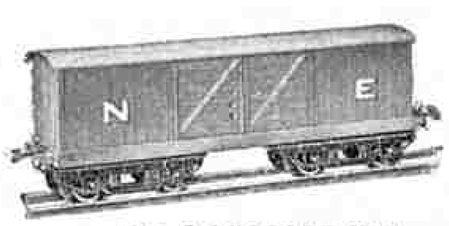
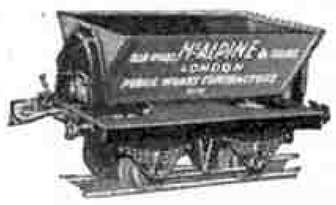
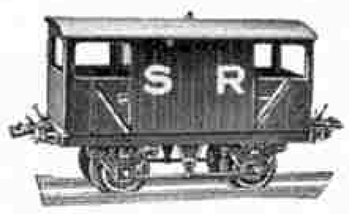
(MO Coupling). Price **1/-**



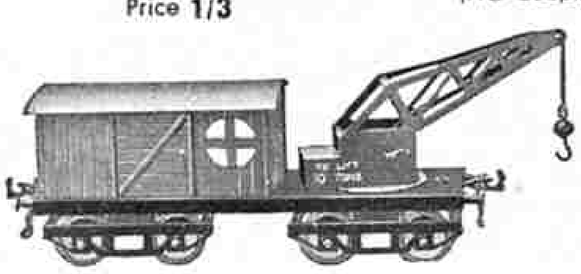
***No. 2 LUGGAGE VAN**
Opening double doors. Not suitable for 1 ft. radius rails. Price **4/6**



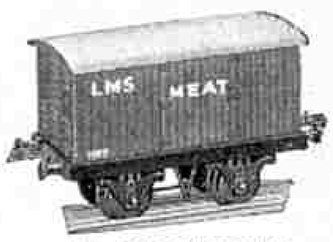
No. 1 SIDE TIPPING WAGON
"Sir Robert McAlpine and Sons." Price **2/-**



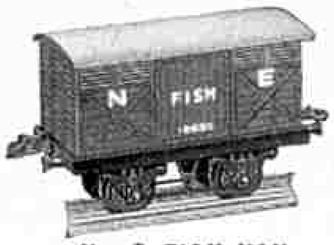
BRAKE VAN
Opening doors. In N.E. or S.R. lettering. Price **2/9**



***BREAKDOWN VAN AND CRANE**
Sliding doors. Not suitable for 1 ft. radius rails. Price **5/11**



No. 0 MEAT VAN
L.M.S., G.W. or N.E., each with correct details. Price **1/6**

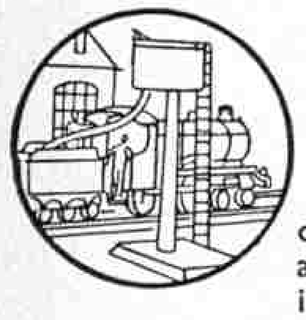


No. 0 FISH VAN
L.M.S., G.W. or N.E., each with correct details. Price **1/6**

TROLLEY WAGON WITH CABLE DRUMS
Fitted with two Cable Drums. Not suitable for 1 ft. radius rails. Price **4/6**

Lettered L.M.S., N.E., G.W. or S.R.

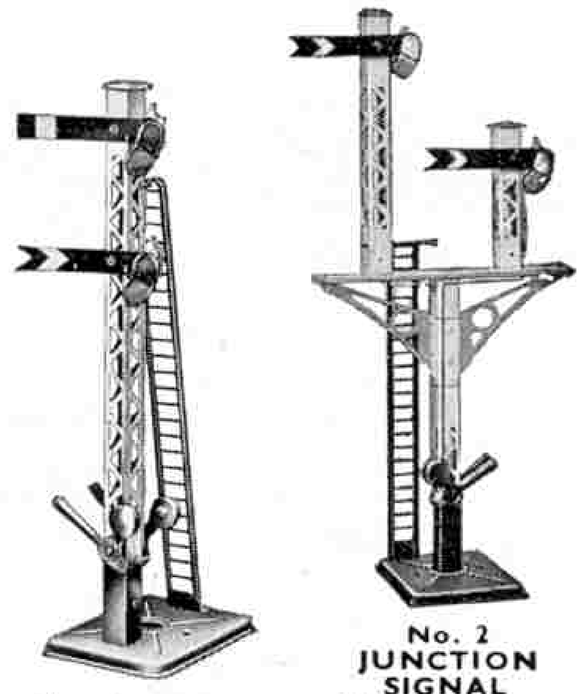
MECCANO LTD., BINNS ROAD, LIVERPOOL 13



HORNBY ACCESSORIES

There is a splendid range of Railway Accessories in the Hornby Series, each one built in perfect proportion and beautifully finished. With these realistic accessories the most elaborate model railway can be constructed and operated in exactly the same manner as a real railway.

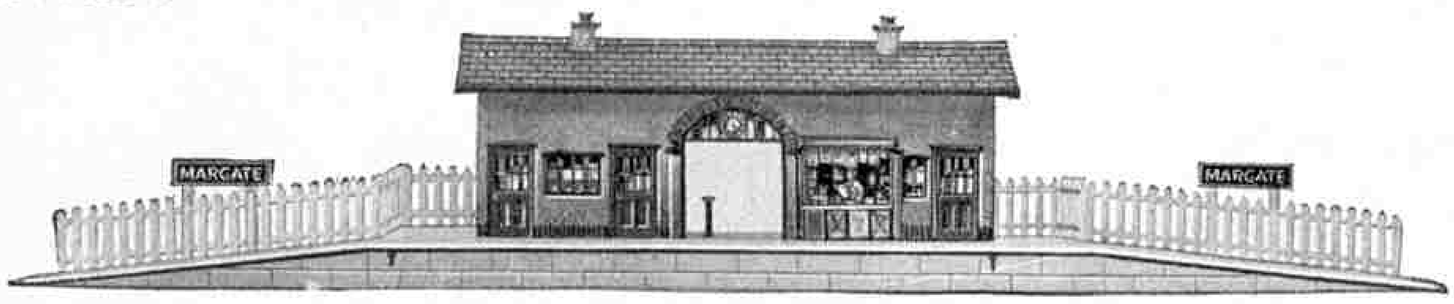
A selection of Hornby Accessories is shown on this page. Ask your dealer to show you the full range.



No. 2 SIGNAL, DOUBLE ARM
"Home" and "Distant."
Price 2/3

No. 2 JUNCTION SIGNAL
"Home" or "Distant." Signal arms operated by levers at base. A very realistic model. Price 5/-

GAUGE O



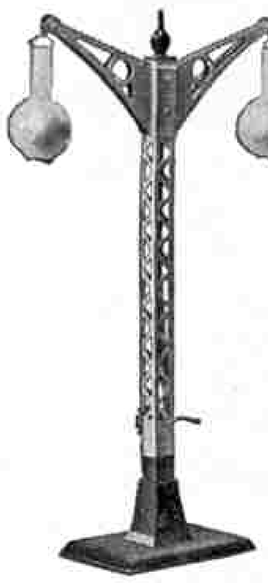
No. 4 STATION
Built up with three detachable sections. Named "Margate," "Wembley," "Ripon" or "Reading." Strikingly coloured, with accessible Booking Hall and Ticket Office Barrier ... ... Price 10/6

No. 4E STATION
This Station is fitted for electric lighting, otherwise it is the same as No. 4 Station ... ... Price 11/9

No. 1 SIGNAL GANTRY
"Home" or "Distant."
Price 4/3

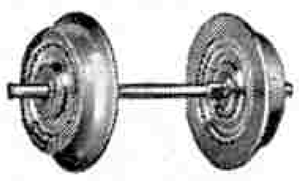
No. 1 WATER TANK
Height 7 in.
Fitted with flexible tube and valve lever
Price 2/6

TELEGRAPH POLES
Price per pair 3/-

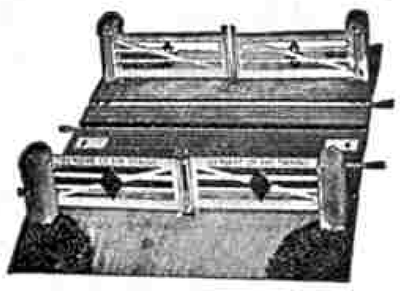


No. 2 LAMP STANDARD
Price 3/9

GRAPHITE GREASE
For Springs.
Price per tube 6d.

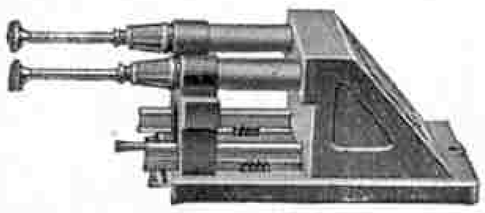


MANSELL WHEELS
These solid die-cast Wheels can be fitted to Hornby Coaches, Vans, etc.
Price per pair 3d.



No. 2 LEVEL CROSSING
Measures 13½ x 10½ in., with two tracks of gauge O rails in position.
Price 5/3

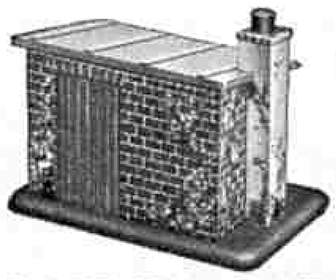
No. E2 LEVEL CROSSING (Electrical)
Similar to Level Crossing No. 2 excepting that a third rail is fitted in each of the two tracks.
Price 7/3



No. 2A BUFFER STOPS
Hydraulic type. Price 2/9

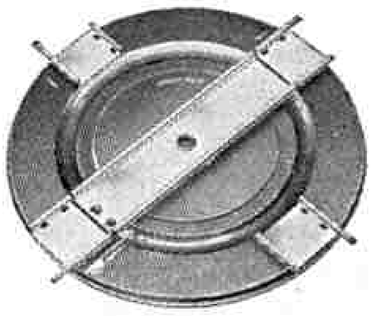
No. 3A BUFFER STOPS
Similar in design to No. 2A Buffer Stops, but fitted for use with Hornby Solid Steel Track. Price 3/6

No. 1 SIGNAL CABIN
Finished in colours.
Price 2/6

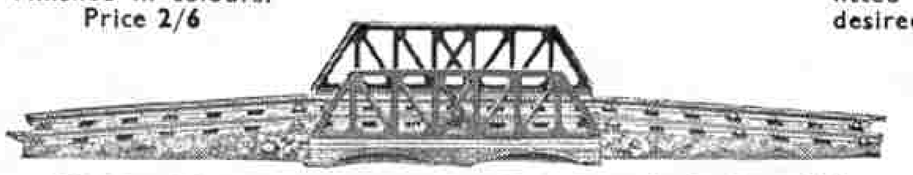


PLATELAYER'S HUT
Price 1/2

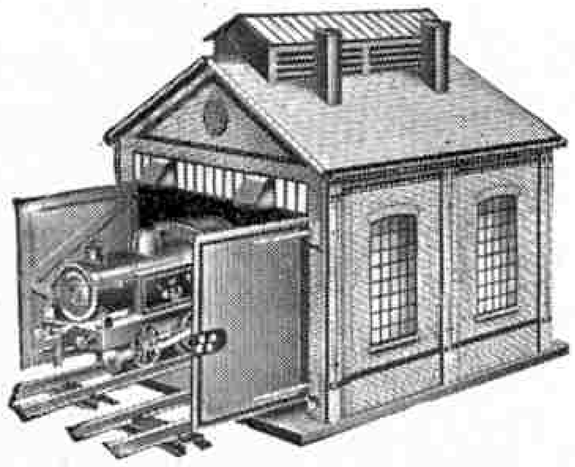
No. 2 SIGNAL CABIN
Dimensions: Height 6½ in., width 3½ in., length 6½ in. Roof and back open to allow Lever Frame to be fitted inside cabin if desired. Price 3/6



No. 1 TURNTABLE
Price 1/11



VIADUCT Price 6/9 **VIADUCT (Electrical)** Price 7/6
VIADUCT Centre Section only ... ... Price 4/6
VIADUCT (Electrical) Centre Section only ... Price 5/-



No. 1 ENGINE SHED
This Shed will accommodate any Locomotive and Tender with an overall length not exceeding 8¼ in. Price 15/6

No. 3 STATION
Length 16¾ in., width 6 in., height 6 in. ... ... Price 5/9

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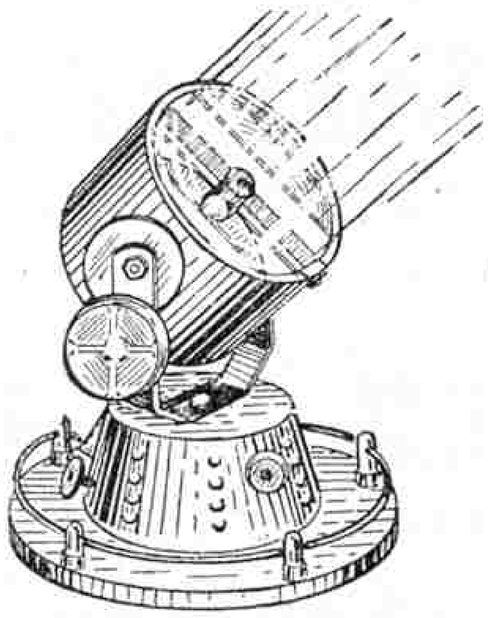
BRITISH MADE



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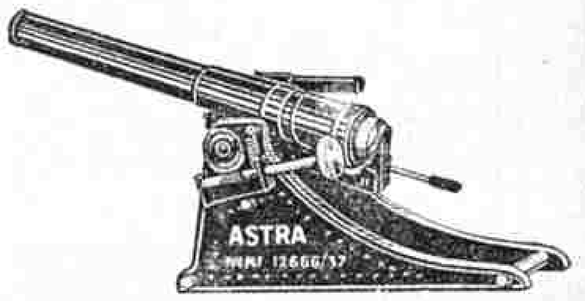
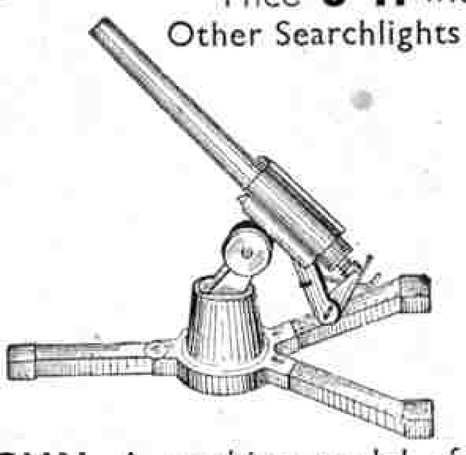
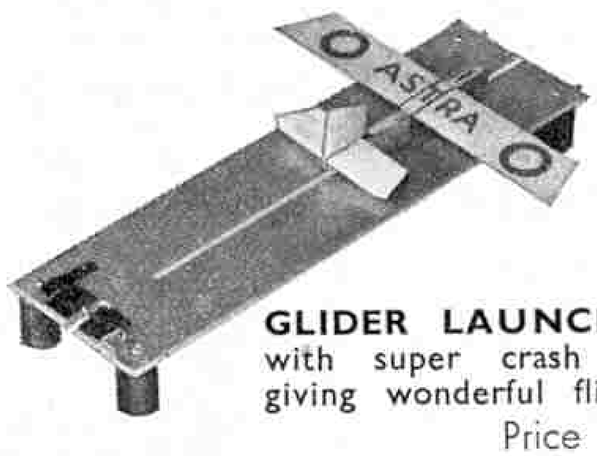


12" HEAVY HOWITZER. Range 50 yards. Complete with elevating gear and telescope sighting. Fires like a real gun by means of caps. Length 10½ inches. Price **10'6**

SUPER SEARCHLIGHT. Complete with elevating gear. TREMENDOUS RANGE. Height 8 inches. Price **3'11** with Battery. Other Searchlights from **1/11**



A.A. GUN. A working model of the latest Gun. Fires projectiles by means of caps with great accuracy. Price **4'6**



GLIDER LAUNCHING DECK with super crash proof Glider giving wonderful flights. Price complete **2'6**

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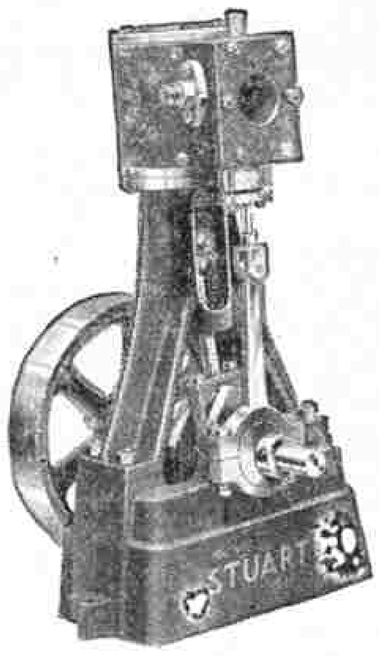
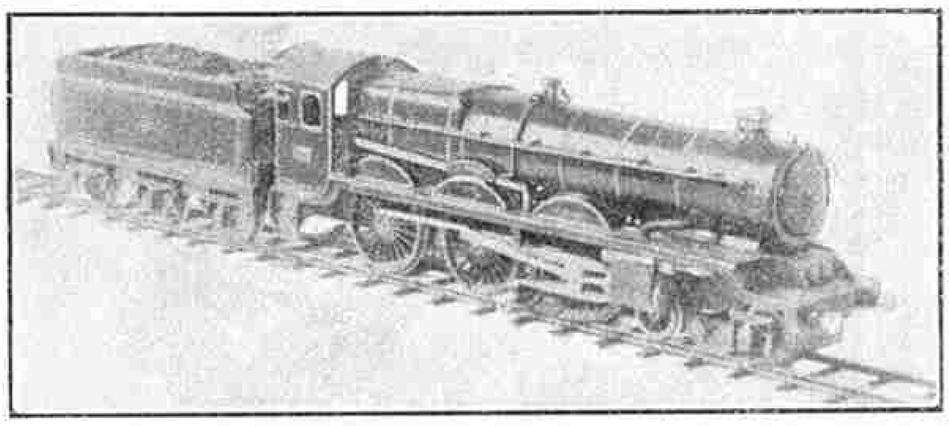


SCALE MODEL RAILWAYS



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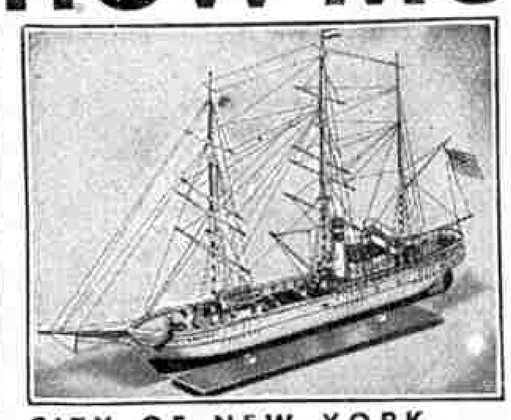

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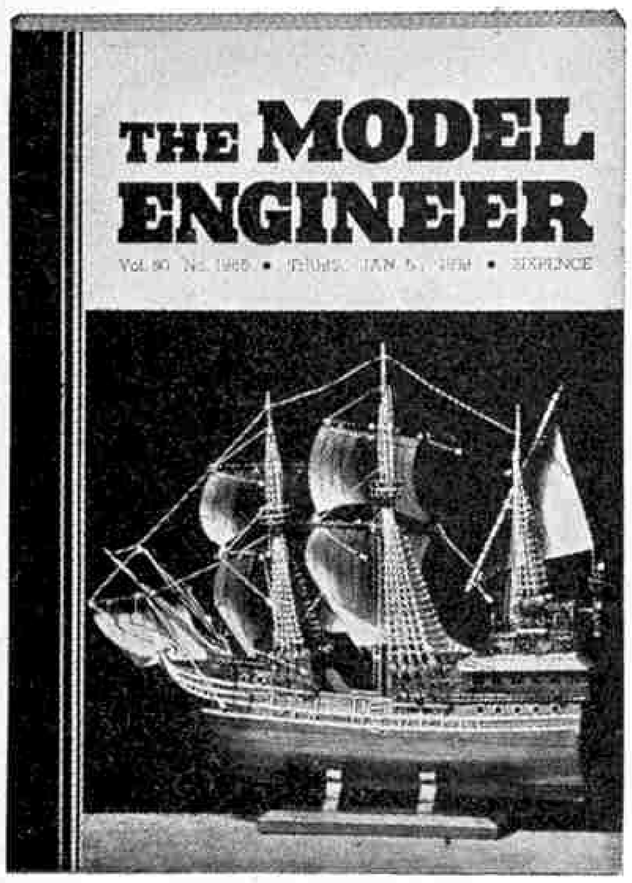

SIXPENCE

January 5th

SOMETHING NEW — for all MODEL MAKERS

The Model Engineer, popular and old established weekly journal, appears in entirely new form as from January 5th. Splendid photographs, first-class drawings and designs, practical articles for expert and tyro by the best writers, give it universal appeal. The best of the old journal has been retained in the new, and the new features and contributors are in keeping with the old, high standard. You will be delighted with it.

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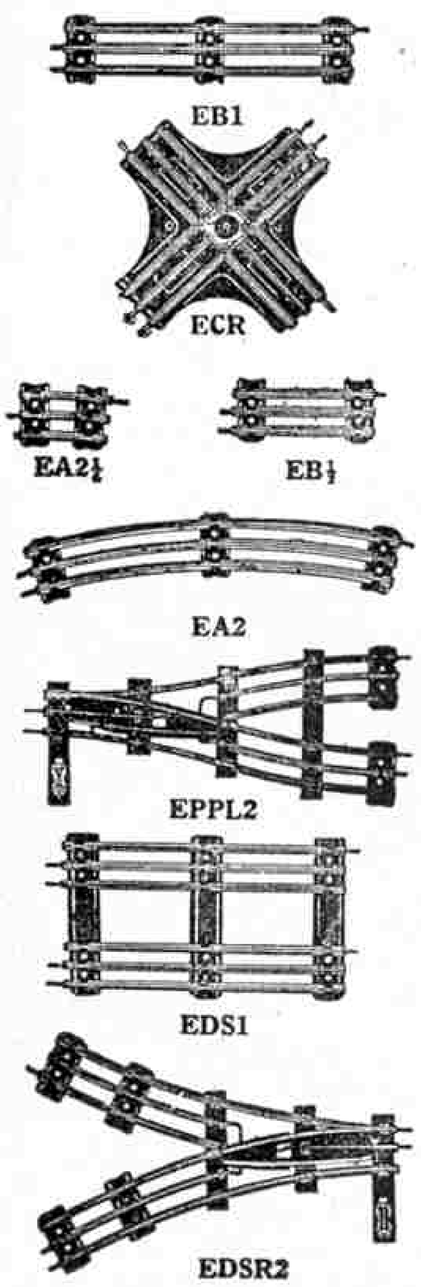


GAUGE 0, 1¼". HORNBY SERIES.

Hornby Rails, Points and Crossings are built for hard wear and for smooth running.

There is practically no limit to the number of rail formations that can be built with them. Their adaptability is well shown in the booklets "How to Plan your Hornby Railway" and "Hornby Layouts–100 Suggestions," both of which may be obtained from your dealer, price 3d., or from Meccano Ltd., Binns Road, Liverpool 13, price 4d.

A SELECTION OF RAILS, POINTS AND CROSSINGS FOR ELECTRIC TRAINS

EB1 Straight rails ... ... per doz. 6/–
EB½ „ half rails ... „ „ 5/–
EA2½ Curved quarter rails (2 ft. radius) ... ... „ „ 4/6
EA2 Curved rails (2 ft. radius) „ „ 6/–
EPPR2 Parallel points, right-hand ... ...
EPPL2 Parallel points, left-hand ... ... } per pair 7/–
These points can be used with either 1 ft. or 2 ft. radius track.

EPR2 Right-hand points (2 ft. radius) ... ... } per pair 8/–
EPL2 Left-hand points (2 ft. radius) ... ...

EPR1 Right-hand points (1 ft. radius) ... ... } per pair 6/6
EPL1 Left-hand points (1 ft. radius) ... ...

EDS1 Straight rails, double track ... ... ½ doz. 8/6

EDSR2 Double symmetrical points, right-hand (2 ft. radius) ... ... } per pair 7/–
EDSL2 Double symmetrical points, left-hand (2 ft. radius) ... ...

EDSR1 Double symmetrical points, right-hand (1 ft. radius) ... ... } per pair 7/–
EDSL1 Double symmetrical points, left-hand (1 ft. radius) ... ...

FOR CLOCKWORK TRAINS

B1 Straight rails ... ... per doz. 4/–
A1 Curved rails (1 ft. radius) „ „ 4/–

PR1 Right-hand points (1 ft. radius) ... ... } per pair 3/6
PL1 Left-hand points (1 ft. radius) ... ...

PR2 Right-hand points (2 ft. radius) ... ... } per pair 3/6
PL2 Left-hand points (2 ft. radius) ... ...

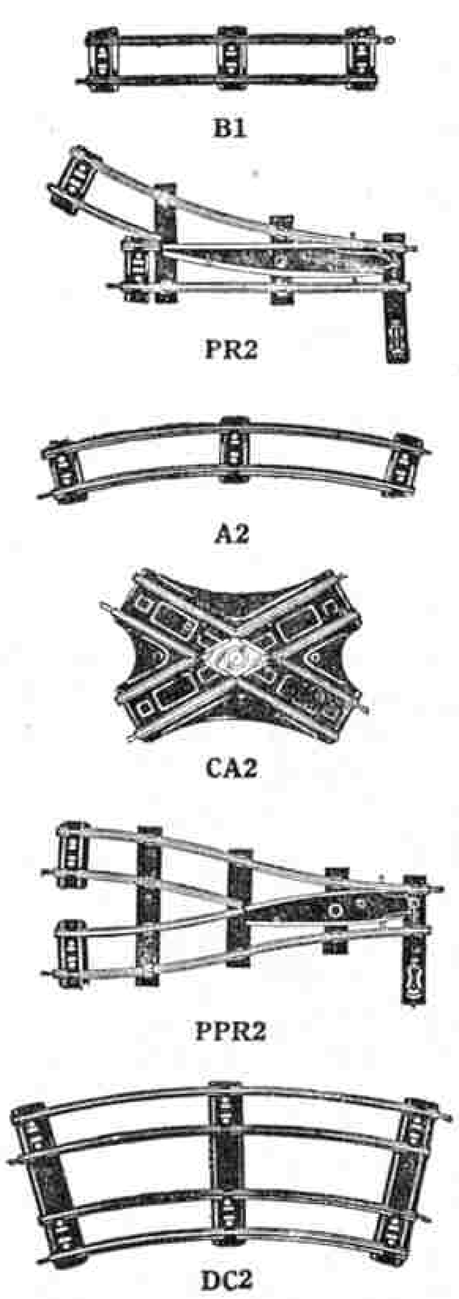
CA2 Acute-angle crossings (for 2 ft. radius track) ... each 1/6

PPR2 Parallel points, right-hand .. ..
PPL2 Parallel points, left-hand ... ... } per pair 4/–
These points can be used for either 1 ft. or 2 ft. radius track.

DC2 Curved rails, double track, 2 ft. radius only ... ½ doz. 6/–

Ask your dealer for an illustrated price list.

MECCANO LIMITED, Binns Road, Liverpool 13



MECCANO
PARTS & ACCESSORIES

REAL ENGINEERING PARTS IN MINIATURE

Meccano parts, many of which are here illustrated, combine to form a complete miniature engineering system with which practically any movement known in mechanics can be correctly reproduced. New parts are always being introduced in order to keep Meccano model-building in line with the most modern engineering requirements. The greatest care is taken in the designing of these parts to ensure that they function exactly as their counterparts in actual engineering practice. Ask your dealer for the latest complete illustrated price list.

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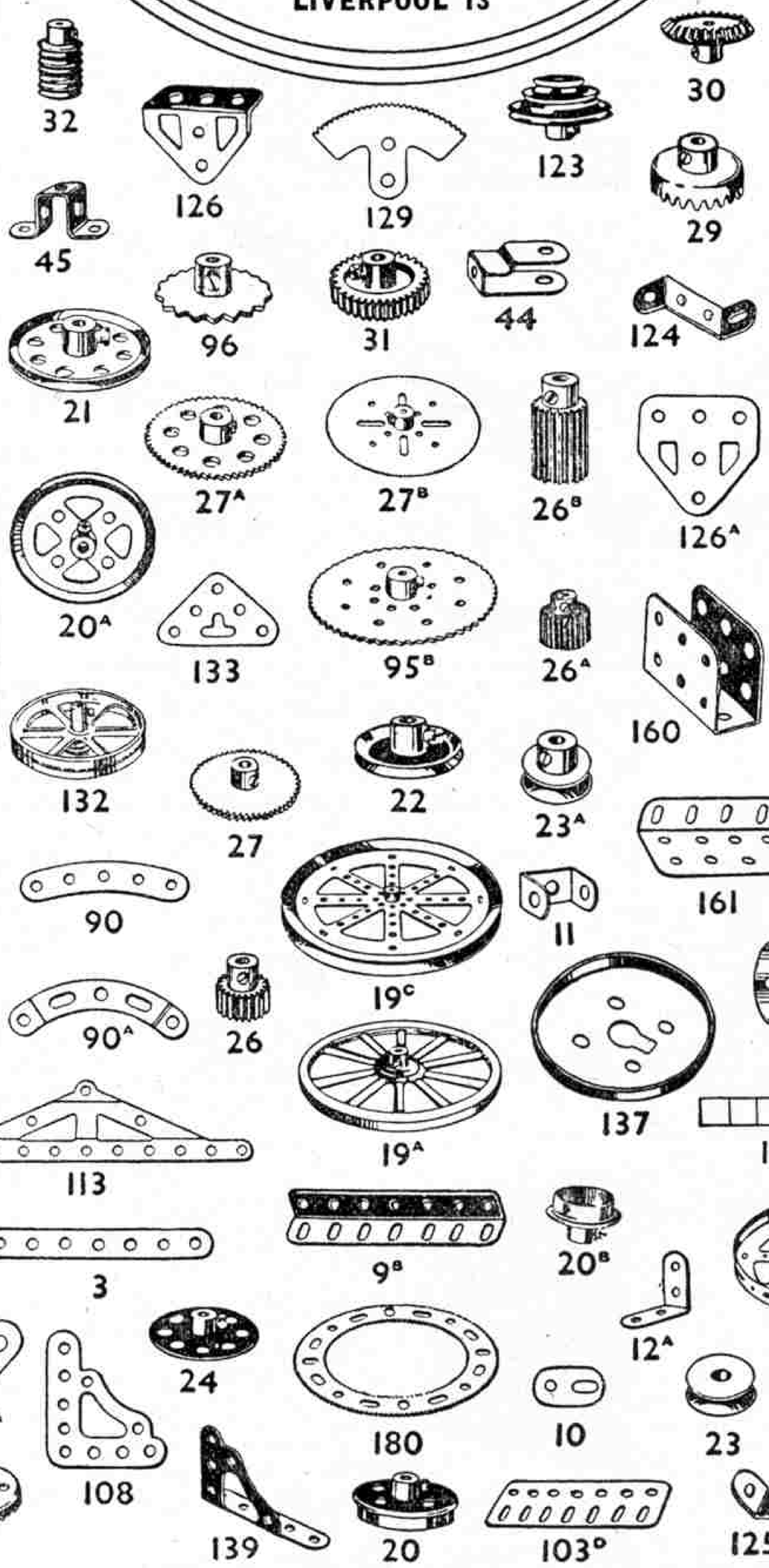
LIVERPOOL 13

PRICES OF PARTS ILLUSTRATED

No.			s.	d.
3.	Perforated Strips, 3½"	½ doz.	0	5
9b.	Angle Girders, 3½"	„	0	9
10.	Flat Brackets	doz.	0	1
11.	Double Brackets	„	0	3
12a.	Angle Brackets, 1" x 1"	„	0	8
19a.	Wheels, 3" diam., with set screws	each	0	6
20.	Flanged Wheels, 1½" diam.	„	0	3½
20b.	„ „ ¾" „	„	0	2½
	Pulley Wheels			
19c.	6" dia., with centre boss and set screw	„	1	9
20a.	2" „ „ „	„	0	3½
21.	1½" „ „ „	„	0	3
22.	1" „ „ „	„	0	2
23a.	½" dia. with centre boss and grub screw	„	0	2
22a.	1" dia. without centre boss and set screw	„	0	1
23.	½" „ „	„	0	1½
24.	Bush Wheels	„	0	2½
26.	Pinion Wheels, ½" dia., ½" face	„	0	3½
26a.	„ „ ½" „ ¼" „	„	0	4½
26b.	„ „ ½" „ ½" „	„	0	6
	Gear Wheels			
27.	50 teeth, to gear with ¾" Pinion	„	0	4
27a.	57 „ „ „ ¾" „	„	0	5
27b.	133 „ „ „ ¾" „	„	1	3
28.	Contrate Wheels, 1½" diam.	„	0	6
29.	„ „ ¾" „	„	0	4
30.	Bevel Gears, ⅞", 26 teeth	„	0	6
31.	Gear Wheels, 1", 38 teeth	„	0	9
32.	Worms	„	0	3½
44.	Cranked Bent Strips	„	0	1
45.	Double „ „	„	0	1
46.	Double Angle Strips, 2½" x 1"	½ doz.	0	8
55.	Perforated Strips, slotted, 5½" long	doz.	1	3
77.	Triangular Plates, 1"	each	0	1
90.	2½" Curved Strips, 2⅜" radius	„	0	1
90a.	2½" Curved Strips, cranked, 1⅜" radius, 4 to circle	„	0	1

PRICES OF PARTS ILLUSTRATED (Cont.)

No.			s.	d.
95b.	Sprocket Wheels, 56 teeth, 3" diam.	each	0	7
96.	Sprocket Wheels, 18 teeth, 1" diam.	„	0	3
102.	Single Bent Strips	„	0	1
103d.	Flat Girders, 3½" long	½ doz.	0	9
108.	Architraves	doz.	1	9
110.	Rack Strips, 3½" long	each	0	2
113.	Girder Frames	„	0	3
118.	Hub Discs, 5½" diam.	„	1	0
123.	Cone Pulley	„	1	0
124.	Reversed Angle Brackets, 1",	½ doz.	0	4½
125.	„ „ „ ½",	„	0	3
126.	Trunnions	each	0	1½
126a.	Flat Trunnions	„	0	1
129.	Rack Segments, 3" diam.	„	0	5
132.	Flywheels, 2¾" diam.	„	2	0
133.	Corner Brackets, 1½"	„	0	1
133a.	„ „ 1"	„	0	1
137.	Wheel Flanges	„	0	2½
139.	Flanged Brackets (R.H.)	„	0	2
145.	Circular Strips, 7½" diam. overall	„	1	0
147.	Pawls, with Pivot Bolt and Nuts	„	0	3
148.	Ratchet Wheels	„	0	4
154a.	Corner Angle Brackets, ½", right hand	½ doz.	0	3
154b.	Corner Angle Brackets, ½", left hand	„	0	3
158a.	Signal Arms, Home	each	0	5
160.	Channel Bearings, 1½" x 1" x ½"	„	0	2
161.	Girder Brackets, 2" x 1" x ½"	„	0	1½
167.	Geared Roller Bearings	„	20	0
168.	Ball Bearings, 4" diam.	„	3	0
170.	Eccentrics, ½" throw	„	0	9
180.	Toothed Gear Ring, 3½" diam. 133 external teeth / 95 internal „	„	1	0
197.	Strip Plates, 12½" x 2½"	„	0	7
200.	Curved Plates, 1 11/16" radius	„	0	1½
211a.	Helical Gears, ½" (Can only be used together)	„	0	10
211b.	„ „ 1½" (Can only be used together)	„	2	3
216.	Cylinders, 2½" long	„	0	3½



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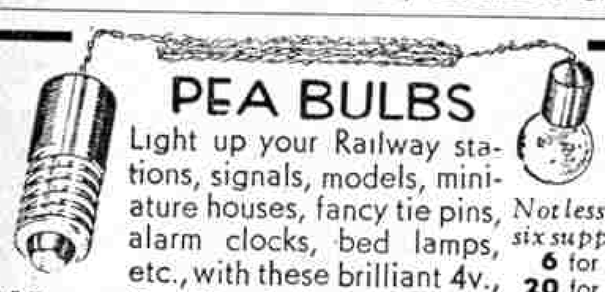

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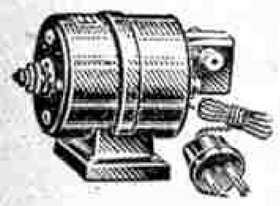

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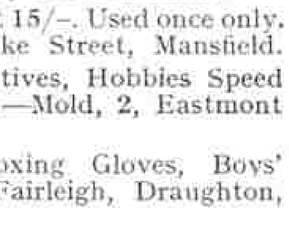

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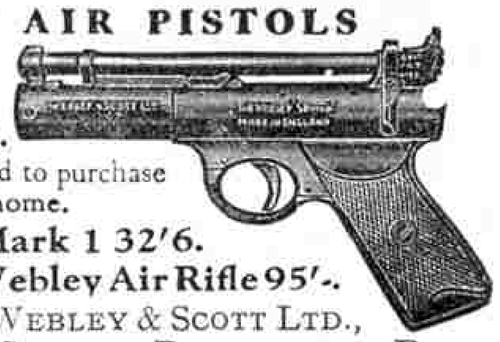

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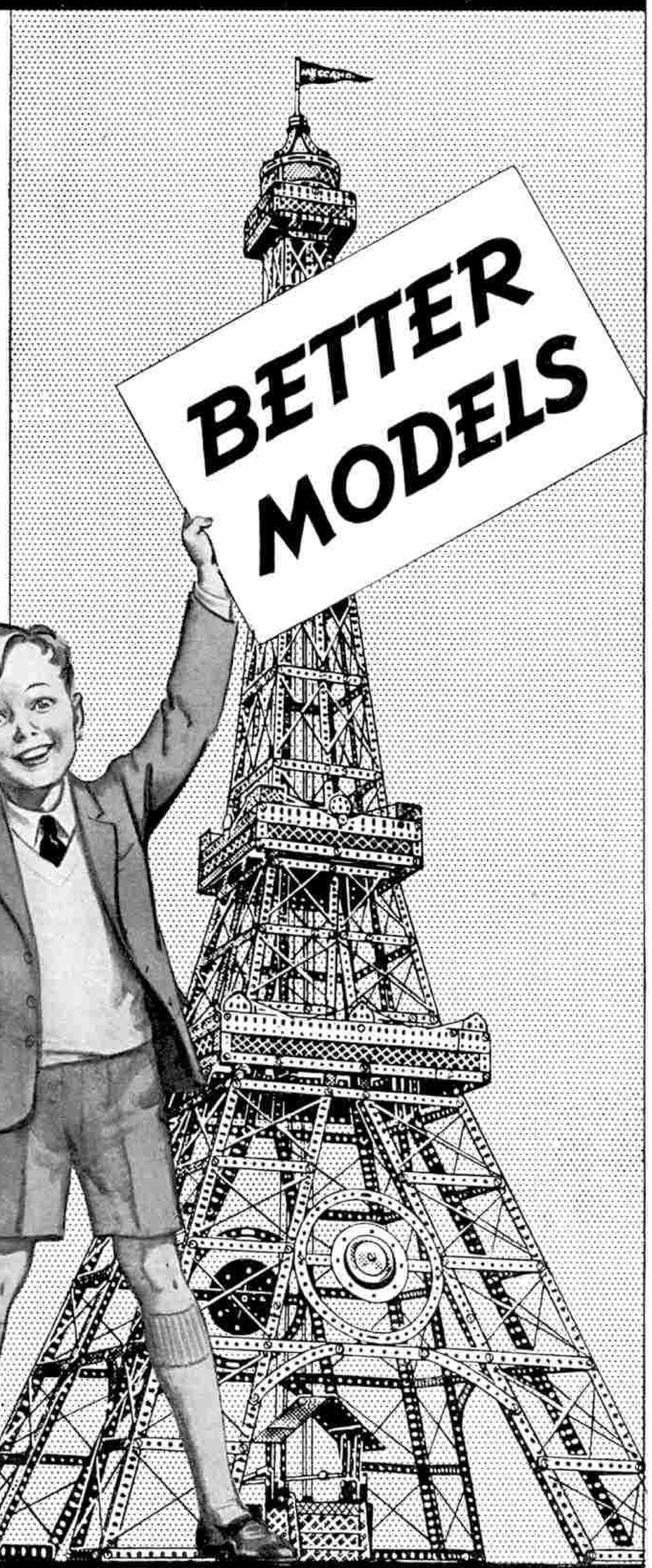

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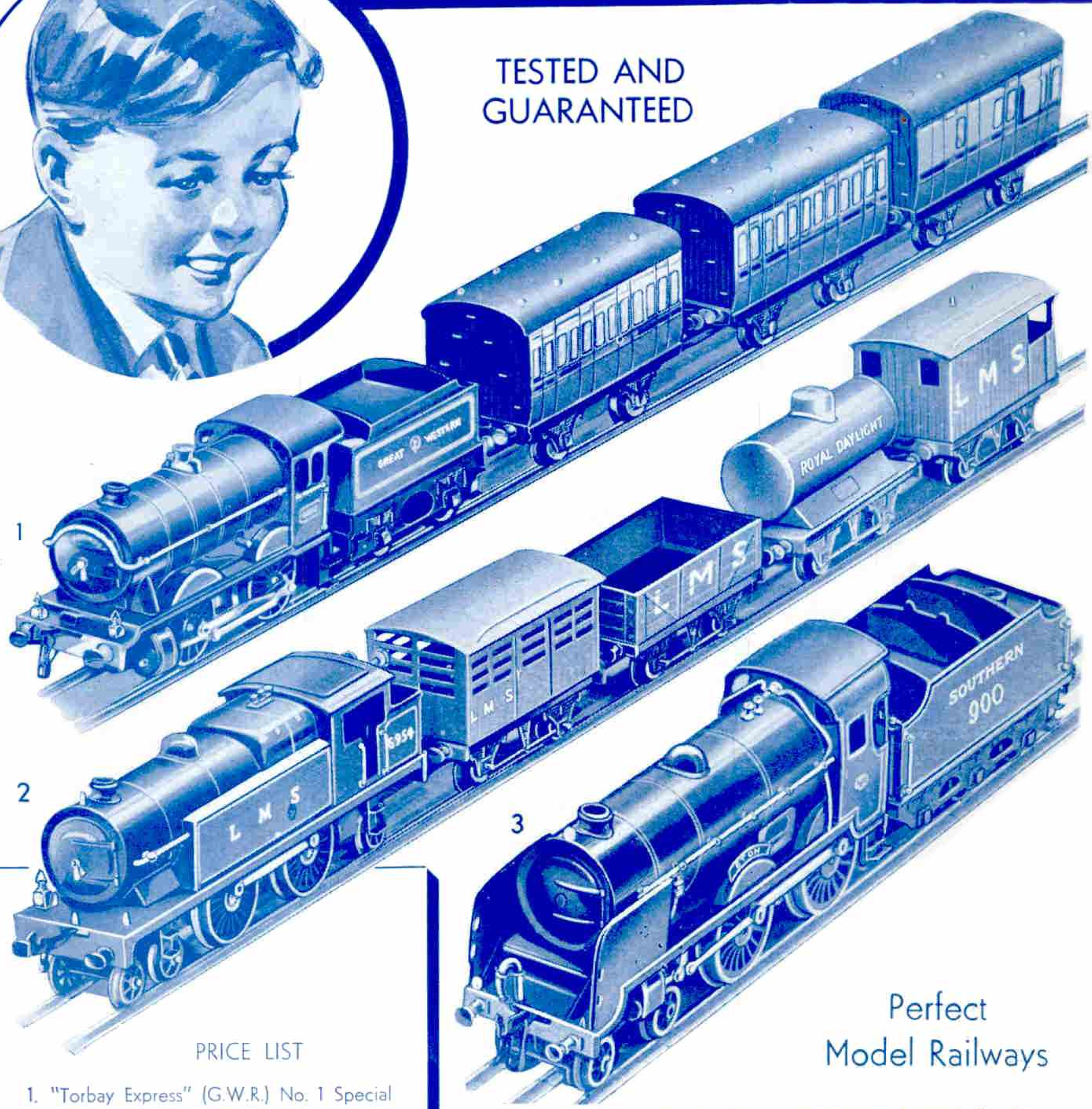

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